Google

Acerca de este libro

Esta es una copia digital de un libro que, durante generaciones, se ha conservado en las estanterías de una biblioteca, hasta que Google ha decidido escanearlo como parte de un proyecto que pretende que sea posible descubrir en línea libros de todo el mundo.

Ha sobrevivido tantos años como para que los derechos de autor hayan expirado y el libro pase a ser de dominio público. El que un libro sea de dominio público significa que nunca ha estado protegido por derechos de autor, o bien que el período legal de estos derechos ya ha expirado. Es posible que una misma obra sea de dominio público en unos países y, sin embargo, no lo sea en otros. Los libros de dominio público son nuestras puertas hacia el pasado, suponen un patrimonio histórico, cultural y de conocimientos que, a menudo, resulta difícil de descubrir.

Todas las anotaciones, marcas y otras señales en los márgenes que estén presentes en el volumen original aparecerán también en este archivo como testimonio del largo viaje que el libro ha recorrido desde el editor hasta la biblioteca y, finalmente, hasta usted.

Normas de uso

Google se enorgullece de poder colaborar con distintas bibliotecas para digitalizar los materiales de dominio público a fin de hacerlos accesibles a todo el mundo. Los libros de dominio público son patrimonio de todos, nosotros somos sus humildes guardianes. No obstante, se trata de un trabajo caro. Por este motivo, y para poder ofrecer este recurso, hemos tomado medidas para evitar que se produzca un abuso por parte de terceros con fines comerciales, y hemos incluido restricciones técnicas sobre las solicitudes automatizadas.

Asimismo, le pedimos que:

+ *Haga un uso exclusivamente no comercial de estos archivos* Hemos diseñado la Búsqueda de libros de Google para el uso de particulares; como tal, le pedimos que utilice estos archivos con fines personales, y no comerciales.
+ *No envíe solicitudes automatizadas* Por favor, no envíe solicitudes automatizadas de ningún tipo al sistema de Google. Si está llevando a cabo una investigación sobre traducción automática, reconocimiento óptico de caracteres u otros campos para los que resulte útil disfrutar de acceso a una gran cantidad de texto, por favor, envíenos un mensaje. Fomentamos el uso de materiales de dominio público con estos propósitos y seguro que podremos ayudarle.
+ *Conserve la atribución* La filigrana de Google que verá en todos los archivos es fundamental para informar a los usuarios sobre este proyecto y ayudarles a encontrar materiales adicionales en la Búsqueda de libros de Google. Por favor, no la elimine.
+ *Manténgase siempre dentro de la legalidad* Sea cual sea el uso que haga de estos materiales, recuerde que es responsable de asegurarse de que todo lo que hace es legal. No dé por sentado que, por el hecho de que una obra se considere de dominio público para los usuarios de los Estados Unidos, lo será también para los usuarios de otros países. La legislación sobre derechos de autor varía de un país a otro, y no podemos facilitar información sobre si está permitido un uso específico de algún libro. Por favor, no suponga que la aparición de un libro en nuestro programa significa que se puede utilizar de igual manera en todo el mundo. La responsabilidad ante la infracción de los derechos de autor puede ser muy grave.

Acerca de la Búsqueda de libros de Google

El objetivo de Google consiste en organizar información procedente de todo el mundo y hacerla accesible y útil de forma universal. El programa de Búsqueda de libros de Google ayuda a los lectores a descubrir los libros de todo el mundo a la vez que ayuda a autores y editores a llegar a nuevas audiencias. Podrá realizar búsquedas en el texto completo de este libro en la web, en la página `http://books.google.com`

This is a reproduction of a library book that was digitized by Google as part of an ongoing effort to preserve the information in books and make it universally accessible.

Google books

https://books.google.com

B 428903

FROM THE LIBRARY OF
Professor Karl Heinrich Rau
OF THE UNIVERSITY OF HEIDELBERG
PRESENTED TO THE
UNIVERSITY OF MICHIGAN
BY
Mr. Philo Parsons
OF DETROIT
1871

ENGINEERING LIBRARY

ARTES VERITAS SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN

1837
ARTES VERITAS SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
E PLURIBUS UNUM
TUEBOR
SI QUAERIS PENINSULAM AMOENAM
CIRCUMSPICE
COLLEGE
OF
ENGINEER

Digitized by Google

TC
773
.U57

Digitized by Google

Digitized by Google

Digitized by Google

U. S. Naval Observatory

REPORT

ON

INTEROCEANIC CANALS AND RAILROADS

BETWEEN

THE ATLANTIC AND PACIFIC OCEANS.

PARSONS LIBRARY
University of
MICHIGAN

BY REAR-ADMIRAL CHARLES H. DAVIS,
SUPERINTENDENT OF THE NAVAL OBSERVATORY.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1867.

Digitized by Google

IN THE SENATE OF THE UNITED STATES.

JULY 12, 1866.—Read and referred to the Committee on Post Offices and Post Roads.

JULY 26, 1866.—*Resolved*, That two thousand five hundred extra copies of the report of the Secretary of the Navy on interoceanic railroads and canals, with the accompanying maps, be printed and bound for the use of the Senate.

FEBRUARY 9, 1867.—*Resolved*, That five hundred additional copies of the report of Admiral Davis, of the Naval Observatory, on interoceanic canals and railroads, be printed for the use of the Observatory.

FEBRUARY 28, 1867.—*Resolved*, That five thousand additional copies of the report of the Secretary of the Navy on interoceanic canals and railroads, with an additional chart, be printed and bound, of which forty-five hundred copies shall be for the use of the Senate, and five hundred copies shall be for the use of the Superintendent of the Naval Observatory.

MARCH 11, 1867.—*Resolved*, That of the copies of the report of Admiral Davis upon interoceanic railroads and canals, heretofore ordered to be printed, three hundred be furnished to the Secretary of the Navy.

Digitized by Google

LETTER

OF THE

SECRETARY OF THE NAVY,

COMMUNICATING,

In compliance with a resolution of the 19th of March, 1866, *a report of Rear-Admiral Charles H. Davis, Superintendent of the Naval Observatory, in relation to the various proposed lines for interoceanic canals and railroads between the waters of the Atlantic and Pacific oceans.*

NAVY DEPARTMENT, *July* 12, 1866.

SIR: I have the honor to transmit herewith a report of Rear-Admiral Chas. H. Davis, Superintendent of the Naval Observatory, prepared by order of this Department, and in pursuance of a resolution of the Senate of the 19th of March last, in relation to the "various proposed lines for interoceanic canals and railroads between the waters of the Atlantic and Pacific oceans."

The report, dated the 11th instant, is accompanied by a series of maps.

Very respectfully, &c.,

GIDEON WELLES,
Secretary of the Navy.

Hon. L. F. S. FOSTER,
President pro tem. of the U. S. Senate.

UNITED STATES NAVAL OBSERVATORY,
Washington, July 11, 1866.

SIR: I have the honor to transmit to the Department a report on interoceanic canals and railroads between the waters of the Atlantic and Pacific oceans, in compliance with your order of March 20, 1866.

This report is accompanied by a series of maps.

Respectfully, your obedient servant,

C. H. DAVIS,
Rear-Admiral, Superintendent.

Hon. GIDEON WELLES,
Secretary of the Navy, Washington, D. C.

356376

Digitized by Google

REPORT

OF THE

SUPERINTENDENT OF THE NAVAL OBSERVATORY,

TO THE

Secretary of the Navy, in answer to Senate resolution of the 19*th March,* 1866, *on interoceanic canals and railroads between the waters of the Atlantic and Pacific oceans.*

The following report is made under the direction of the Hon. Secretary of the Navy, in compliance with a resolution of the Senate of the United States, dated March 19, 1866, which resolution reads as follows:

"*Resolved*, That the Secretary of the Navy furnish, through a report of the Superintendent of the Naval Observatory, the summit levels and distances by survey of the various proposed lines for interoceanic canals and railroads between the waters of the Atlantic and Pacific oceans; as, also, their relative merits as practicable lines for the construction of a ship canal, and especially as relates to Honduras, Tehuantepec, Nicaragua, Panama, and Atrato lines; and also whether, in the opinion of the Superintendent, the isthmus of Darien has been satisfactorily explored; and if so, furnish in detail, charts, plans, lines of levels, and all information connected therewith, and upon what authority they are based."

The object of this inquiry is to collect and collate our existing information concerning the several isthmuses through or over which it has been proposed to open a communication between the Atlantic and Pacific oceans. It is the aim of the Honorable Senator, Mr. Conness, of California, to acquire by the answer to his resolution, such accurate knowledge with regard to the whole question as will, in the first place, prevent the re-examination of any ground which is already sufficiently known; and, in the second place, will prevent any useless expenditure of money upon schemes that are infeasible or unpromising.

The resolution is properly divided into two general heads, which are again subdivided as follows:

I. The consideration of the "various proposed lines" will include—
"Summit level;"
"Distances by survey;" and
"Their relative merits as practical lines for the construction of a ship canal, especially for the Honduras, Tehuantepec, Nicaragua, Panama, and Atrato routes."

II. The inquiry, "Has the isthmus of Darien been satisfactorily explored," calls for—
"Charts;"
"Plans;"
"Lines of levels, and information therewith;" and
"Authorities on the whole subject."

In conference with the mover of the resolution, I have ascertained that I shall execute the task assigned me in the most acceptable manner, if I confine myself to a simple statement of facts, avoiding all unnecessary descriptions, whether of geography, topography, or natural history, all scientific details not required for a full comprehension of results, and all merely speculative opinions.

In truth, nothing would seem to be less called for at the present day than a renewed attempt to show by argument, whether based on statistical or other

Digitized by Google

considerations, the advantages of a suitable artificial water communication between the two great oceans. This project has engaged the attention of the most eminent statesmen, political economists, engineers, and merchants of the world, from a period but little subsequent to the discovery of this continent. Minds of the largest comprehension have employed themselves in the contemplation of the benefits that would flow to mankind from the successful accomplishment of this purpose.

By promoting intercourse, and therefore peace and good will among men, it would contribute as much to human progress as any of the leading discoveries of the century. It is entitled to this highest commendation, that it will elevate the authors of its execution to the rank of those in history who have deserved most of their fellow-men. The ingenious and enterprising thinkers of this country and of western Europe will never rest satisfied until this project is either carried out or is shown by a thorough examination, such as leaves no question unanswered, to be totally impracticable. I will so far anticipate the conclusions of this report as to say that my study of the subject rejects the latter idea.

With these preliminary remarks, I will enter at once upon the business of the report, under the several divisions and subdivisions heretofore enumerated:

I. The various proposed lines for interoceanic canals and railroads and their relative merits, viz:

A. Tehuantepec;
B. Honduras;
C. Nicaragua;
D. Panama;
E. Atrato.

A.—Tehuantepec.

The attention of the early discoverers was drawn towards this isthmus by two of its features—one, the remarkable depression of the Mexican plain at this point, and the other, the hydrographic basin of the Coatzacoalcos, which drains the northern slope of the sunken Cordillera and discharges itself into the Gulf of Mexico.

Mr. Williams, who is our best authority with regard to this part of the continent, divides the isthmus of Tehuantepec into three distinct divisions, each possessing its own characteristic peculiarities. The first, or northern division, lying between the Cordilleras and the Gulf, he calls the Atlantic plains; the second, or middle division, the mountainous district; and the third, or southern division, bordering on the gulf of Tehuantepec, he calls the Pacific plains.

In the series of maps appended to this report (No. II) I have copied his two profiles, one of which extends from ocean to ocean, while the other comprises the mountainous districts only. These maps contain in themselves all the details necessary to a correct understanding of the ground. They were prepared, it will be remembered, with reference to a railroad project only. But for many years the idea had been entertained of opening a canal between the two oceans; and this idea received a sudden impulse in 1771, from the unexpected discovery in the port of San Juan de Ulloa that some cannon cast at Manilla had crossed the isthmus by the rivers Chimalapa and Coatzacoalcos. (Humboldt—Essai Politique.)

This discovery led to the most extravagant expectations, and gave rise to a succession of surveys or examinations under the governments of the Viceroyalty and of the Republic, which surveys are of little value at the present time. The really accurate and reliable survey of the isthmus was made by the scientific Commission under the direction of Major (now Major General) J. G Barnard, United States Engineers, in 1850–'51, and it is this which has fur-

Digitized by Google

nished us with our profiles. From this survey we learn that this route possesses but little "merits as a practicable line for the construction of a ship canal."

B.—HONDURAS.

Our knowledge of this isthmus is derived from hydrographic, topographic, and barometrical surveys, instituted by the directors of the British Honduras Interoceanic Railway Company, and reported by the general agent of the company, E. G. Squier, Esq., August 1, 1858.

Since it has never been proposed to construct a canal on this route, it will not be necessary to speak of it at length. The third of the appended maps is both a map and profile of the whole line between the bay of Honduras and the bay of Fonseca. The reader who follows the course of the surveyors, naturalists, and geologists from the capacious, safe, and excellent harbor of Puerto Caballos (Port Cortes) through regions remarkable for their salubrity, fertility, great variety of climate and productions, and valuable mineral resources, to the waters of the splendid harbor of La Union, cannot but regret that capitalists have not found it to their interest to carry out one of the most promising, and one of the least embarrassing, enterprises of the day.

But, so far as concerns its relative "merit as a practicable line for the construction of a ship canal," Honduras is excluded from our further consideration.

C.—NICARAGUA.

There has been a time when the transit from ocean to ocean, on a line following the river San Juan del Norte, either in its bed or on its banks, crossing Lake Nicaragua, and thence to the Pacific, has enjoyed special favor and attention. From Greytown to the lake the mode of proceeding has been the same in most of the plans. It has included the improvement of the navigation of the river San Juan, where possible, by excavations in its bed, and by the construction of dams, which, with the rapids of the river, were to be passed by means of locks and canals. But, from the lake to the Pacific outlet, various branches have been proposed. Three of these pass through Lake Managua; a fourth terminates at Brito; a fifth, at San Juan del Sur; a sixth proceeds by the Sapoa river to Salinas bay; a seventh, keeping in the southern part of the State of Nicaragua, proposes to cut from the river San Juan, through the State of Costa Rica, to Nicoya gulf. Only two of these routes have been carefully surveyed, those terminating in Brito and San Juan del Sur.

There are so many difficulties attending all these routes, which detract from their "relative merits as practicable lines for a ship canal," that I should feel authorized, under ordinary circumstances, to pass over this region in a few words; but so much has been said and written about it by eminent authorities that I feel called upon to present some descriptive details.

A variety of circumstances have concurred to concentrate public opinion and favor upon this route. I refer particularly to the accidental settlement of Greytown; to the establishment of a transit through Nicaragua; the actual navigation of the San Juan river, and of Lake Nicaragua; the connexion of eminent names, including that of the present French Emperor; and the agricultural and mineral wealth of the Chontales region. And to these circumstances may be added the advances seemingly made by nature in offering the water communications of San Juan and the lakes, which reduce the isthmus to one-tenth of its whole breadth. Extravagant expectations have been fostered, and hasty schemes have been formed, including extensive plans of colonization—schemes that never have reached maturity.

The late Admiral Fitz Roy, in the first paper which he presented to the Royal Geographical Society, on the isthmus of America, entered into a careful examination of this line and its branches, and maturely considered the value of

Digitized by Google

the statements made by its advocates, and the feasibility of the project with reference to the natural difficulties to be overcome. The conclusion at which he arrived was unfavorable.

I take pains to cite the authority of this distinguished hydrographer, because it will be received with the highest respect by all who are acquainted with his useful labors and great abilities. It is not worth while to follow him over the same ground; to discuss the statements of Mr. Bailey, or the data of the French Emperor, or to dwell upon the unfavorable conditions arising from climate, earthquakes, volcanoes, &c. I will base what I have to say upon the report of the survey made by Messrs. Childs and Fay, in the years 1850–'51, for the American Atlantic and Pacific Ship-Canal Company.

The map appended to this report, numbered IV, contains a profile of the line surveyed; and this profile may be regarded as a type of the whole region, embracing all the branch lines mentioned above. It is not at all probable that any other of the proposed routes would find either a lower summit level or easier cuts.

The line selected by Colonel Childs proceeds from Lake Nicaragua by a short and easy route to the harbor of Brito. It traverses the lake directly to its outlet at Port San Carlos; it employs slack-water navigation on the San Juan river for a distance exceeding ninety miles, and then pursues a canal, independent of the river, to the harbor of San Juan del Norte. This plan of operation requires fourteen (14) locks to descend from the lake to the Pacific ocean, and fourteen (14) locks to descend from the lake to the Caribbean sea, in which last enumeration are included light locks at dams on the San Juan. There are seven (7) dams on the river. Costly improvements, possessing the character of artificial harbors, will be necessary at the two points of departure from the lake. The seaports of Greytown and Brito, at the two ends of the line, will require costly and extensive improvements in the way of excavations, piers, jetties, breakwaters, &c. The total length of the line is a little more than one hundred and ninety-four (194) miles. It may be safely asserted that no enterprise, presenting such formidable difficulties, will ever be undertaken with even our present knowledge of the American isthmuses. Still less is it likely to be entered upon while such strong and well-founded hopes are entertained by the promoters of the union of the Atlantic and Pacific oceans of finding elsewhere a very much easier, cheaper, and more practicable route for a canal, in every way suited to the present demands of commerce and navigation. The relative merits of the Nicaragua route as "a practicable line for the construction of a ship-canal" do not require further consideration.

I have taken Childs's survey as a standard. I will therefore mention that it is regarded by Squier and other competent authorities as the authentic and reliable survey of the Nicaragua route; and, further, that in March, 1852, his drawings, reports, and estimates were submitted to the examination of Colonels Abert and Turnbull, United States engineers. Squier's language in regard to the survey is very emphatic; he says, "Childs's survey is the only one to be accepted as conforming to modern engineering requirements." Childs's report was further submitted by the Earls of Malmesbury to English engineers, who also questioned its author personally. They reported that, "presuming Colonel Childs's data and statements to be correct, the harbor of Brito is, in size and shape, unworthy of this great ship navigation."

CHIRIQUI.

The next line in the order of our enumeration is Panama; but there lies between Nicaragua and Panama another isthmus which has been thought of more than once as a convenient place of transit—the isthmus of Chiriqui.

The best information concerning this route is derived from the examination

Digitized by Google

made by the Chiriqui commission, commanded by Commodore Frederick Engle, United States navy, of which Commander Jeffers was the hydrographic engineer, and First Lieutenant J. St. Clair Morton, who fell at Petersburg, the topographical engineer. Commodore Engle describes the harbor of Chiriqui as "large, deep, and well protected." Commander Jeffers confirms the accuracy of the survey of Captain (now Rear-Admiral) Barnett, Royal Navy, and adds: "No finer harbors can be found than those on the Atlantic side, Shepherd's harbor included." He says also of Golfito, in Golfo Dulce, on the Pacific side, that it "is unsurpassed in natural facilities; * * * three streams, the Golfito, Coisal, and the Canaza, enter the harbor and afford an ample supply of fresh water." Lieutenant Morton landed at Frenchman's creek, and crossed the isthmus twice; in doing which he explored a swamp of great extent, and discovered a hitherto unknown pass through the Cordilleras. His examination resulted in "the conviction that it is entirely practicable to connect the harbors by a line of railroad adapted to commercial purposes." But since Lieutenant Morton describes his work as a reconnaissance merely, made with the Schmalcalder compass, and has left no map, journal, or note-book in the archives of the War Department, I am unable to trace his route precisely, and have accordingly laid it down on the general map with a broken line.

Mr. Evans, the geologist of the Chiriqui commission, made examinations to ascertain the extent and value of the coal deposits on the Chiriqui lands. He found "coal seams varying in quality from lignites to semi-bituminous and semi-anthracite coals." * * "The supply is abundant." He found "gold and ores of iron, copper, and platinum, * * a rich mineral region." The plains are described as being fertile, and abounding in timber. Concerning a portion of the province of Chiriqui, known as the territory of Burica, we have some interesting information from J. H. Smith, esq., of Panama, a Fellow of the Royal Geographical Society. I have cited him among my authorities for the convenience of the future student or explorer, when this region is again brought under examination.

COSTA RICA.

At the very moment of our writing, another project of an interoceanic railroad is presented to the world in a pamphlet entitled "The Interoceanic Railroad through the Republic of Costa Rica, by F. Kurtze, C. E., Director general of public works, Republic of Costa Rica. New York: Gray & Green, 1866."

This route starts from Port Lemon on the Atlantic, below Point Blanco, and bordering on the tenth parallel of latitude. After running in a straight direction due west across the level ground to the foot of the mountains, it turns to the northward and follows the course pointed out by nature, skirting the different spurs of the Cordillera, and crossing the minor streams until it reaches the right bank of the Reventason, which it follows for some distance, gradually ascending up to the table lands of Cartago. Near Cartago, at Ochomogo, it reaches the summit level, which is five thousand one hundred and eighteen feet above the sea level; thence it descends into the fertile plains of San José and passes close to the capital of the same name. From the plains of San José it descends into the valley of the Rio Grande, and terminates in the noble gulf of Nicoya, at a point called Caldera, from the hot mineral springs in its vicinity.

This route possesses, in a marked degree, the advantages ascribed to the Honduras route. It passes through a territory the physical geography of which exhibits a variety of forms, the soil of which embraces large differences of productions, and the climate of which is rendered salubrious, even under the tropics, by the moderateness due to great elevations. Its mineral resources, also, are rich and diversified. In length it is a hundred miles shorter than the Honduras route; but its gradients are more difficult, and its summit level exceeds that of Honduras by more than two thousand feet.

Digitized by Google

But this project comes before the public embellished with one recommendation peculiar to itself. Throughout the strip of territory, not exceeding eight miles in breadth, in which the line of railroad lies, the government of Costa Rica has constructed (with the exception of a few miles at the Atlantic end which is fast being completed) a wagon road from sea to sea, described by the director of public works as a substantial, macadamized highway, with a number of cut-stone bridges. It is said that in many places mile after mile of this wagon road can be used without further leveling. This road is declared to be sixty feet wide, and therefore able to spare the width of the track.

Although this route is wholly excluded from our consideration of "practical lines for the construction of a ship canal," yet I have given it a little space on account of its interest and importance. It requires no uncommon foresight to predict that unless some unexpected calamity occurs to obstruct the growth of the healthy, vigorous, fertile, and flourishing Republic of Costa Rica, portions of this road, at least, on the northeastern slope will be built from time to time if only to meet the wants of local travel and traffic. For, as Mr. Kurtse observes, "it is but a single step from a substantial macadamized highway to a railroad with its trains of freight and passenger cars;" and the people which has been obliged to build the former, for the accommodation of a valuable and rapidly increasing commerce, is not far from the construction of the latter.

D.—Panama.

There is no part of the American isthmus with which we are so well acquainted as the old route from Porto Bello or Chagres to old or new Panama, the established line of communication since the year 1532—that is, since twenty-three years after the first settlement in America. The surveys made by the engineers of the Panama railroad have established the important fact that the difference between the mean level of the two oceans is either nothing, or so slight as to present no obstacle to the construction of a canal. The difficulties pertain altogether to the climate, to the elevation, the nature of the soil, and the supply of water. The character and extent of these difficulties may be learned from the survey and project of M. Garella, Ingénieur-en-chef des Mines, in 1843. In order to present the whole subject in the most satisfactory manner, I have included among the maps appended to this report (No. V) M. Garella's survey and profiles, containing all the details of his project.

This route was selected only after a careful inspection of the intervening space, and after making the requisite levellings. It will be seen by this map that he follows the valleys of the Bernardino and Caimito on the southern descent, and those of Quebrado and Chagres on the northern. The mountainous region approaches very near the Pacific, and its highest elevation is four hundred and fifty-nine (459) feet above the level of the sea. He tunnels the mountain at about ninety-nine (99) metres (324 feet 9 inches) below its highest point; and he establishes his summit-level for a distance of 25,361 feet, at an elevation of one hundred and thirty-five (135) feet above high water from the Pacific ocean. From this summit-level he descends to the Pacific ocean by means of seventeen (17) locks; some of which are necessarily very much crowded. On the other side he descends to the Atlantic by eighteen (18) locks, which, owing to the more gradual descent on the north, are more conveniently spaced.

It is remarked by the commission of the "Ponts et Chaussées," appointed to report upon M. Garella's project, that his mode of proceeding is reasonable, and entirely in conformity with the rules of art.

A glance at the plan and profile shows that the near approach of the chain of the Andes to the Pacific ocean obliges him to pursue the course he has adopted. Of the whole length of the summit-level, seventeen thousand five hundred and fifty feet are subterranean; and, as the Commission observes, this is not only inconvenient to vessels, but it involves great expense, since the tunnel must be

Digitized by Google

sufficiently high to allow vessels to pass through with their lower masts, at least, standing.

The means of feeding the canal are not satisfactorily stated. The river Chagres was gauged, it is true, at Cruces and at Gorgona, but the river is to be tapped above these points. Provision is also made for an auxiliary reservoir; still, the commission is not satisfied on this question.

The harbors which form the termini of the canal are, on the Atlantic side, Navy bay, and, on the Pacific side, the bay of Vaca del Monte. We know that Navy bay is an insecure anchorage at certain periods of the year, and the harbor on the Pacific is altogether insufficient for vessels of even moderate draught. M. Garella is obliged to include in his estimates a sum of a million and a quarter of dollars for the improvement of this harbor. I have entered into these details of M. Garella's project—all of which are more fully displayed on the map—because it presents a fair representation of the difficulties to be overcome in the construction of a navigable ship canal across the isthmus of Panama proper; and in order to render this subject still more intelligible to the general reader, I have added Colonel Hughes's survey of the Panama railroad in map No. VI, which contains the topographical features and profile of the route.

I have spoken of the isthmus of Panama proper. Geographers have given the name of Darien to that part of the isthmus which is contained between the Panama line and the province of Choco. On this isthmus of Darien, as we shall call it, between the Panama line and the province of Choco, there are three other lines or places which have always commanded great interest, but which have never received the attention they merit. These three routes are from the Chepo or Bayanos river to San Blas or Mandinga* bay, from the Gulf of San Miguel to Caledonia bay, and from the Gulf of San Miguel to the southern part of the Gulf of Uraba or Darien, or else to some point on the lower part of the Atrato below the mouth of the Cacarica. I will take up these three in the order now mentioned.

The first of these lines, from Chepo to San Blas, has always been the subject of special curiosity on account of the jealous exclusion by the Indians of all strangers from their territory. Our accurate knowledge of the geography of the coasts on both sides enables us to determine that here is the narrowest part of the isthmus. This is of itself an important fact; and added to this, a rumor or report has been received from the Indians in this vicinity that they are in the habit of hauling their canoes on wooden slides across the Cordilleras from the Mandinga river and launching them in the waters of the Bayanos. This rumor, which is noticed by many writers, is particularly mentioned by Mr. Oliphant, the secretary of the Royal Geographical Society, in a paper read before that society on the 24th of April, 1865. The writer of that paper made a journey from Panama to the Chepo or Bayanos river simply for a reconnaissance, and he says that the tide of the Pacific extends to within fifteen (15) miles of the northern coast, and that he saw from Chepo a remarkable depression in the mountain chain about ten miles distant. He makes the remark, in which all will concur, that it is a discredit to the civilization of the nineteenth century that this part of the isthmus should not have been explored. This is not owing, however, to a want of effort. Attempts to cross the isthmus at this point were made by Mr. Hopkins and Mr. Wheelwright. They were both driven back by the aborigines.

It is very gratifying to have it in my power to say that this discredit to the civilization of the nineteenth century has been removed by the indefatigable zeal and enterprise of Mr. Frederick M. Kelly, of New York, of whom it was justly said by the President of the Institution of Civil Engineers of London, that he "had produced more intelligible information towards the solution of this problem, of such vast importance to the commercial and political interests of the

*Also called the Gulf of Manzanilla.

Digitized by Google

world, than had hitherto been given;" and of whom Sir R. Murchison, Vice-President of the Royal Geographical Society, also said that he "heartily wished he might succeed in this great and philanthropic project, which so deeply interested all civilized nations." After having spent a great deal of labor and money upon the examination of the Atrato and San Juan rivers in search of a suitable route for an interoceanic canal across the province of Choco, Mr. Kelly and his friends, in 1864, took up the long deferred but much coveted exploration of the route from the Chepo to the Gulf of San Blas. The results of this exploration are given in the annexed map, numbered VII.

From Mr. Kelly's plans it will be perceived that the whole length of the route from ocean to ocean is only thirty miles. On the north, there is the admirable, spacious, and deep harbor of San Blas; and on the south the channel leading into the bay of Panama has not less than eighteen (18) feet of water at mean low tide, while the ordinary rise of tide is sixteen (16) feet. I give these figures from Mr. Kelly's survey; but I must observe that this result of the examination by his engineer of the entrance of the Chepo is entirely unexpected, and does not accord with the admiralty charts. But the most striking feature of the project, as of M. Garella's, is a tunnel, similar in its length, and in other respects, to the great tunnel through the Alps at Mont Cenis, which is nearly one-half cut through, and in which the progress is so satisfactory that the period of its completion can be definitely fixed.

When the tunnel through Mont Cenis, and the still greater one through Mont St. Gothard, are finished and in use, such undertakings will cease to be regarded with the aversion we now feel towards them.

It must be observed, however, with regard to Mr. Kelly's survey, that owing to its being a private affair it was necessarily accomplished at the least expense and with the utmost expedition. It pursued a single line, without deviating to the right or left, although the surveyors were satisfied that they saw evidences of greater depression to the westward of their course; and there can be no doubt whatever that a deliberate examination, made under such advantages as would pertain to a governmental survey, would lessen the difficulties, and, perhaps, lead to the discovery of such a route through the valleys as would render a resort to tunnelling unnecessary. This subject will be resumed in the general remarks and recommendations with which the report will be concluded.

GULF OF SAN MIGUEL TO CALEDONIA BAY.

The next place in order is the line between the gulf of San Miguel and Caledonia bay. We have here, at both ends of the line, harbors spacious and admirable in every respect, and, on the south side, there is a height of tide suited to the construction of docks for repairs, &c. It is held by many persons that no line of interoceanic canal merits serious attention unless it possesses this indispensable requisite of good natural harbors, requiring no artificial improvements, except those for the ordinary conveniences of commerce, such as wharves and docks. Certainly it will add very much to the difficulties and embarrassments, as well as to the expense, of this great enterprise, to mix with it any doubtful questions of harbor improvement.

The greatest interest has always centred in this particular line on other accounts. The first settlement in all America was in this vicinity, and the next settlement on the isthmus was at Agla, a few miles inland, on Caledonia bay. It was through this district of country that the buccaneers made frequent incursions upon the original Spanish settlers, who had opened and were working mines at Cona or Cana and Espiritu Santo. The history of the buccaneers furnishes us with many interesting accounts of their incursions into this region. But since their topographical descriptions are not full enough to be traced on any modern map, it is sufficient merely to refer to them.* It was, no doubt,

*It may be said, on the authority of Fitz Roy, that they can be followed on the old Spanish maps.

Digitized by Google

owing to the success of the buccaneers that Paterson was induced to settle at Darien with his Scotch colony. He derived the information on which he acted, in part, from personal intercourse with the surviving buccaneers. In one of his letters to the court of directors of the "Indian and African Company," cited by Dalrymple in his Memoirs of Great Britain, vol. 2, page 115, he says: "Gold may be gotten in very many places. No mines are worked or looked after that yield as low as $\frac{1}{2}$ ounce per day to the laborer. Often they yield 4 ounces per day. The mine of Cana is worked by a thousand negroes."

In our own time, this line of communication has received more attention than any other, except the Panama line. The governments of Great Britain, France, and the United States have each undertaken its exploration, with a singular want of success. One English surveyor, Mr. Gisborne, entered the country from Caledonia bay, and, after reaching the summit of the Cordillera, turned back. Captain Prevost, of the royal navy, led the exploring party which ascended the Savana from the gulf of San Miguel to the head of navigation, and thence cut his way through the woods and swamps until he reached the Cordillera, when he also turned back. He says in the official report of his proceedings, under date of January 4, 1854: "Although finding ourselves in the centre of the Cordilleras, and, I believe, within a very few miles of the object of our search, yet, having already exceeded the limits of my stay, it became my duty to rejoin the ship without delay, still feeling confident that had time and our provisions allowed us, we should eventually have reached the Atlantic shores, and that easily, by following one of the several rivers or streams which appear to exist in this range of hills, forming certain passages to the sea."

The expedition of Strain, though it called out a remarkable display of courage and endurance under the most fearful trials, was even less fruitful of knowledge than those of Gisborne and Prevost.

I have appended a map, numbered VIII, of the joint exploration of the two English gentlemen here mentioned, taken from Gisborne's report to the Royal Geographical Society. It will be perceived that the routes of these two gentlemen join on to each other. Sections of both tracks are given on the map.

The only person in our time who claims to have crossed the isthmus directly between the two great bays is Dr. Cullen. Dr. Cullen says that on his first journey into Darien, in 1849, he was totally ignorant of the existence of the Savana river until he actually saw it, after entering Boca Chica, "when," he continues, "finding the great depth of water at its mouth, and that it flowed almost directly from the north, I became convinced that I had at last found the object of my search, viz., a feasible route to the Atlantic; and thereupon I immediately ascended it, and crossed from Cañasas to the sea-shore, at Port Escocés, and back; and subsequently, in 1850, and also in 1851, crossed and recrossed at several times and by several tracks the route from Savana to Port Escocés and Caledonia bay, notching the bark of the trees as I went along with a *machete* or cutlass, always alone and unaided, and always in the season of the heaviest rains. * * * And I had not the least hesitation in deciding that that must be the future route for interoceanic communication for ships." (Isthmus of Darien Ship Canal, by Dr. Cullen, 2d edition, p. 19.)

The principal point of interest in this exploration is, of course, the passage of the Cordillera. Concerning this, Dr. Cullen says: "From the sea-shore, (Port Escocés,) a plain extends for nearly two miles to the base of a ridge of hills which runs paralled to the coast, and whose highest summit is about 350 feet. This ridge is not quite continuous and unbroken, but is divided by transverse valleys, through which the Aglaseniqua, Aglatomate, and other rivers have their course, and whose highest elevations do not exceed 150 feet. The base of this ridge is only two miles in width, and from its south side a level plain extends for thirteen miles to a point on the river Savana, called Cañasas, which is about twenty miles above its mouth." (Page 28, *ibid.*)

Digitized by Google

No language could be more simple, explicit, and direct than the language of this statement. Admitting it to be literally correct, we have to go no further; for the object of our search, the existence of a practicable route for an interoceanic ship canal, has been discovered.

Dr. Cullen's map, numbered IX of the series appended to this report, presents a line of communication which combines all the advantages required by the engineer. It possesses the indispensable requisite of harbors of perfect security, sufficient depth of water, and large capacity at both termini—that on the Pacific side having a rise of tide which adapts it to the construction of building and repairing docks, a circumstance the value of which cannot be overestimated. It cuts the Cordilleras at a depression at least thirty feet below any that has ever been reported, and several hundred feet below any that has actually been surveyed, or that has been approximately determined by trustworthy observers. The course of this line is direct, free from obstructions, and exceptionally healthy, while its outlets open upon coasts where violent storms are rarely known. The plains on each side of the dividing ridge are of easy slope and readily penetrated. The Savana river itself would form a part of the canal. And, finally, accepting the particular statement of Dr. Cullen as fully reliable, a ship canal may be cut on this line without locks, and even without tunnel, and yet not surpass, either in difficulty, in labor, or in the amount of time or money consumed in its construction, several other monuments of human genius and enterprise in past times and in our own day.

Thus, for example, the Mexican Desague, of which Humboldt says: "In its actual state it is undoubtedly one of the most gigantic hydraulic operations ever executed by man. We are filled with admiration when we consider the nature of the ground, and the enormous breadth, depth, and length of the aperture. If the cut were filled with water to the depth of ten metres (32.8 feet) the largest vessels of war could pass through the range of mountains which bound the plains of Mexico to the northeast." (Humboldt, New Spain, vol. 2d, pp. 110, 111.) "This wonderful work," says Admiral Fitz Roy, "200 feet deep and 300 feet wide for nearly a thousand yards, and above 100 feet deep through an extent of three thousand yards, (making altogether two miles of distance in which that vast excavation would be capable of concealing the masthead of a first-rate man-of-war,) executed within the last three centuries within Central America, should induce us to listen respectfully to the plans of modern engineers, however startling they may appear at first." (Journal Royal Geographical Society, vol. 20, p. 176.)

A ship canal twenty-six or twenty-seven miles in length, on such a line as that described by Dr. Cullen, (pp. 24, *et seq.*) with a cut of two miles only through hard rock, would, in all respects of time, money, and difficulty, fall far short of that tunnel which is now in progress under the Alps at Mont Cenis, for the purpose of connecting France and Italy by a continuous railway. The length of this tunnel is seven miles and 1,044 yards. At Mont Cenis it is, in section, twenty-six feet three inches, and twenty feet eight inches high above the rails. Throughout the whole line it passes through rock, and, in some places, very hard rock. This, by far the greatest and boldest work of the kind ever yet undertaken, with its covered drain throughout, its lining of masonry, its recesses at the distance of every fifty metres, (164 feet,) and its chambers ten or twelve feet square at intervals of 1,650 feet, may well spur us on to engage in this enterprise, which has for its object the union not of two adjacent countries, but of remote continents; the promotion, not of interior traffic in one or two districts, but of commerce and intercourse between all the peoples of the habitable globe. I say this because the construction of an interoceanic ship canal is—to borrow the thought of an eloquent writer on this subject—the same thing as if by some revolution of our globe the eastern shores of Asia and the southern continent were brought nearer to us.

Digitized by Google

Such are the prospects which the statements of Dr. Cullen offer to us. But it is with extreme reluctance I am compelled to say that these statements stand in Dr. Cullen's book as mere assertions, unaccompanied by notes or measurements. I cannot but join with Admiral Fitz Roy in his regret that Dr. Cullen has not given to the world the journals and details of his repeated explorations; such, for example, as are given by Gisborne and Prevost on or about the same line. However, it is a great satisfaction to observe that Admiral Fitz Roy gives Dr. Cullen credit for "valuable information gleaned from archives, maps, books, oral accounts and his own personal observation, and for being the first to ascertain the existence of a low summit-level." He adds that Dr. Cullen's statement "is corroborated by Gisborne;" and ascribes to Dr. Cullen the merit "of recommending from personal observation the river Savana as preferable to the Chuquanaque on account of its nearer approach to the north coast."

It is also gratifying to perceive that Airiau, who has made a careful study of this subject, has arrived at the same conclusion; that is, that the proper line for an interoceanic canal is from the bay of San Miguel up the river Savana to its junction with the Lara, and from this point straight across the plain to the foot of the Cordilleras. (Prevost's route, approximately.) "With regard to the Cordillera, in proportion as it advances, proceeding from the base of the isthmus, it descends a good deal, and is only, so to speak, a range of hills or isolated peaks, the bases of which are intersected by ravines which point out to the engineer the true route of the canal. The Indians in the neighborhood of Caledonia bay make use of these passages. One of them is elevated about fifty metres, (164 feet,) and is covered with a luxuriant growth of mahogany, palm, ebony, and other trees." (Canal Interoceanique par l'Isthme du Darien, p. 52. See list of authorities appended to this report.)

The same writer describes the country on the north of the Cordillera as a slope, gradually descending to the water's edge. No special authority is given for this description of the Cordillera, though Gisborne and other travellers are generally quoted; and it is further to be remarked that Airiau's estimates (chap. iv) are based upon probabilities, not on actual measurement, and these probabilities are deduced from Garella's survey, as well as from the statements of Gisborne and others.

Besides Cullen and Airiau, there are other high authorities who have regarded the isthmus of Darien as the place where we are to look for the consummation of our wishes. Admiral Fitz Roy, who, at the period when he last wrote, 1853, had made a more careful and accurate study of the whole subject than any man then living, and whose opinions no one experienced in the hydrography of the globe will lightly question, has said: "A strong conviction remains on all our minds that Darien should be surveyed without delay. The illustrious Humboldt declares himself thoroughly satisfied that the isthmus of Darien is superior to any other portion of the entire neck for a canal."

But we can go further back in our authorities. The incursions of the old buccaneers, Dampier, Ringrose, Sharp, Wafer, and Davis, which can be followed on the old Spanish maps, have made us strangely familiar with some parts of this region, abounding in the gold that was the object of their search. The well-known and productive mines of Cona and Espiritu Santo, partly on account of these very incursions, were long since abandoned. We also follow, without difficulty, the direct route (1788) of the Spanish officer, Don Manuel de Milla Santa Ella, from Caledonia harbor to El Principe, thence down the Savana river to the harbor of Darien, up the Tuyra, and again up the Chuquanaque to Yavisa. While stopping in this village he received information from the governor that two hostile Chucunaque Indians were pursuing his tracks. On this, he determined to send his Indian guide Urruchurchu forward with the despatches and go back himself and return to Carolina by the way of Panama and Porto Bello. (Cullen, pp. 192 *et seq.*)

Digitized by Google

And, lastly, we must adduce the testimony of that very remarkable man, William Paterson, who carried with him, in his settlement at Caledonia harbor ample stores of information collected from the buccaneers, who, during his long residence, had leisure and opportunity to make himself acquainted with the surrounding district, and who made at least one journey into the interior, the journal of which is given in his papers. One hundred and seventy years ago, the far-reaching mind of Paterson had contemplated the isthmus of Darien with the same enlightened views as the statesmen and political economists of the present time. He originated and partly executed the project of settling a great colony in this then remote region for the purpose of "removing distances and drawing nations nearer to each other." In one of his letters to the Darien company, he says, (what is as true now as it was then,) "the time and expense of navigation to China, Japan, the Spice islands, and the greater part of the East Indies, will be lessened more than one-half, and the consumption of European commodities and manufactures will soon be more than doubled. * * * Thus this door of the seas and key of the universe, with anything of a reasonable management, will, of course, enable its proprietors to give laws to both oceans and become arbitrators of the commercial world."

This, however, is not said in any narrow spirit of selfishness; for, he adds, "You may easily perceive that the nature of these discoveries is such as are not to be engrossed by any one nation or people to the exclusion of others." And he denounced the contrary policy as being no less ruinous than niggardly.

I might extend these and similar quotations almost indefinitely. A glance at the list of authorities on this subject of interoceanic communication, appended to this report, will suffice to show how easy it would be to so stretch out this paper to any extent by historical, geographical, hydrographical, statistical, and descriptive passages and illustrations. I am, however, free from any temptation to do so, for I am well aware that I shall best answer the end of the call under which I am writing by confining myself as strictly as possible to the actual state of our knowledge of the great isthmuses, and to the channels into which new attempts are to be directed. But I will not forbear to mention that it is interesting to the American statesman of the present day to see in what light the possession of the isthmus was regarded by a British statesman of the latter part of the last century. (*Vide* Dalrymple's Memoirs, vol. 2, p. 111.)

I have still one more exploration in this region to mention, the last one of which we have any accurate knowledge, but by no means the least interesting and profitable. I refer to the expedition of M. Bourdiol, civil engineer, who was employed in 1864, by a French society, to conduct a new exploration on the isthmus of Darien. For the greater convenience of supplies for his party, he found it expedient to begin on the Pacific side. His expedition comprised twenty-five persons, of whom one was an Indian and nine were negroes. M. Bourdiol's course lay from the mouth of the Lara across the isthmus to the river Chuquanaque, which he reached at a point a little below the Sucubti. Here he was obliged to turn back, all the natives having abandoned him through fear of the hostile aborigines (the *bravos*) on the northern slope of the Cordilleras. This expedition of M. Bourdiol is full of instruction for the future surveyors of the isthmus, not only on account of the manner in which it was conducted, but on account of its failure to reach the Atlantic shore. M. Bourdiol had made better preparation than any of his predecessors. He introduced into his work accuracy, zeal, and laborious industry. He encountered great hardships, and yielded only when the obstacles to his progress became insurmountable.

His narrative in the Bulletin of the Geographical Society of Paris, 1864, will be attentively read by every one who is to follow in his track. But the principal lessons to be derived from it may be summed up as follows:

First. The imperative necessity of taking provision in a concentrated form, on which I dwell more than once in this report, is very clearly shown. The

Digitized by Google

want of provisions was one of the insurmountable obstacles that obliged him to turn back. It appears to have been impracticable to supply the party from the vessel when they had reached the interior.

The second and equally important lesson is, that the proper season is to be selected. Bourdiol attempted to make his exploration in the month of May. At one time he was in danger of having his retreat cut off by the enlargement of the streams, and by the torrents created by the abundant rains. At another time he was wading up to his waist in water; and, in order to make sure of a safe return across an inundated plain, he left, as he advanced, his people stationed at intervals like live beacons. But for this precaution he might never have found his way back; and, in spite of it, he came near losing one of his men.

Thirdly. I speak elsewhere of the necessity of providing the means of clearing the way through the dense and matted undergrowth by steel and by fire. (Page 22.) M. Bourdiol's experience on this point is exceedingly instructive. The natives may be employed with their *machetes*. They are strong, active, and enduring, but are very timid, and not to be relied upon.

Fourth and lastly. Suitable preparation must be made for encountering the hostility of the Indian *bravos* who inhabit the Atlantic declivity.

This is the proper place to call special attention to the benefits which have been conferred upon the world by all previous explorers, whether their labors have been carried on systematically and to an end, or have been cut short by accident, hostility, or a want of proper equipment.

Every successful and complete survey, like those of Tehuantepec, Honduras, Nicaragua, Panama, &c., which has proved the unfitness of the route for an interoceanic communication by canal, has benefited us by eliminating these points from our consideration, and thus narrowing down our field of inquiry. Every unsuccessful attempt has conferred a benefit by teaching us the precautions we are to observe, and the errors we should avoid.

FROM SAN MIGUEL TO GULF OF URABÁ OR DARIEN.

The remaining line on this part of the isthmus is that which ascends the Tuyra and crosses to the valley of the Atrato. It is satisfactory to know that a plan for a survey of this route is already on foot. Mr. Gogorza, a resident of New Granada, has recently communicated the discovery of a short and easy transit across the Cordillera at this point. According to his statement, the mountain is depressed to an elevation of fifty-eight metres (190 feet) above the level of tide-water; the distance between the waters, navigable by canoe, on the two sides of the mountain, is only three miles.

Since the verification of these estimates is about to be undertaken by competent authority, it is not expedient to say anything further on this route than this: that it is expressly pointed out by Fitz Roy, and drawn on his general map, and that it is also mentioned at length by Trautwine. A regular survey by the government would be desirable, whether the present private enterprise on foot should make any important discoveries or not.

E.—The Atrato route.

For many years explorations have, from time to time, been carried through the valley of the Atrato to various points on the Pacific coast in search of a suitable path for effecting a union of the two oceans by a ship canal without locks. These explorations have, in one respect, been satisfactory. They have been conducted by able engineers, who enjoyed the confidence of the public, and they have been given to the world in the most useful and intelligible form. We are now sure that we are well acquainted with the region, especially in those particular parts over which the surveyors have passed. Whoever will take the pains to study the maps and reports of Trautwine, Kennish, and Colonel Mich-

Digitized by Google

ler of the United States engineers, will be able to form an independent opinion with regard to the practicability of finding in this direction the means of fulfilling the world's expectation of a passage through the great American isthmus. It is well known that we are indebted to one gentleman, principally, for all these trustworthy contributions to our geographical knowledge.

In the year 1852, Mr. Kelly, of New York, influenced by the early reports of Humboldt, (who, however, it must be remembered, does not here speak from his own knowledge, but merely recites what is communicated by others,) and inspired by the grandeur of the object, commenced a series of surveys, beginning at the mouth of the Atrato river, and crossing the Cordilleras at several points. Of these surveys I will here give a brief account, in order to show precisely where we stand in regard to this region. What is here said concerning the early history of these undertakings is taken, in part, from a paper communicated to the Royal Geographical Society of London, by its secretary, Dr. Norton Shaw, in 1856.

The first expedition, undertaken at the expense of Mr. Kelly and other gentlemen, was placed under the direction of Mr. J. C. Trautwine, an engineer of Philadelphia, who had already acquired distinction in Honduras and in the work of the Panama railway. Mr. Trautwine surveyed the mouth of the Atrato, and then ascended the river to Quibdó, examining several of its tributaries in passing. Above Quibdó he followed first the tributary Quito, and then the tributary Pato to its source; here he crossed the dividing ridge of the Cordilleras, and took a canoe on the river Baudo, which he traced to its mouth on the Pacific. Returning on his steps he turned off from the Baudo, at the mouth of the Pepé, which river he ascended to its source, and crossed the mountains on a second track to the river Surucco, one of the headwaters of the San Juan, and proceeded along the last-named river on a third track. He crossed from San Juan to Quibdó, which track leads across the water-shed said to have been intersected by the famous Raspadura canal. The existence of this canal is now disproved, if the word canal is intended to signify a practicable artificial water-course, constructed and employed for the passage of boats or vessels.*

This route was again traversed by Mr. Trautwine, when he returned from Quibdo, and navigated the river San Juan throughout its length to the bay of Chirambira, on the Pacific coast. Thus it will be seen that Mr. Trautwine during his expedition crossed the Cordillera at three different places. A copy of Mr. Trautwine's map is included in the appended series and numbered X; it embraces his plan and elevation of the dividing ridge between the Atrato and San Juan rivers.

In 1853, another expedition was fitted out by Mr. Kelly, at his own expense, and placed in charge of Mr. Lane and Mr. Porter, civil engineers of New York, with instructions to extend and follow up the investigations of Mr. Trautwine. Mr. Porter pursued the route previously taken by Mr. Trautwine, ascending the Atrato, and crossing over the dividing ridge to San Pablo, on the San Juan. His observations harmonized entirely with those of his predecessor. Mr. Lane, after examining the Atrato to Quibdó, took the eastern course along the Atrato to the Andagueda, whence he crossed the dividing ridge to the San Juan. He also examined the supposed Raspadura canal. Throughout his expeditions his results agree with those previously reported by Mr. Trautwine.

We may sum up the results of these surveys, so far as the question of an interoceanic canal is concerned, in the following declaration: The examina-

* It is worth mentioning, as a matter of curiosity, that this canal of Raspadura has been actually laid down on a large chart of South America, and also on a chart of Columbia, both by Brué, and also on a chart of New Granada, given by Malte Brun, père, in the 16th vol. of the Annales des Voyages for the year 1811. This last chart passed under Humboldt's review. (Malte Brun, fils, 1857, p. 22, note.)

tion of the headwaters of the Atrato, of the intervening water-shed, and of the headwaters of the San Juan, satisfactorily proved that nature forbids us altogether to entertain the idea of a union of the two oceans in this direction.

Mr. Kelly's indefatigable spirit of inquiry took a new course. Humboldt had been told that from the bay of Cupica eastward, for a distance of fifteen or eighteen miles, the ground was level and suitable for a canal which would terminate on the river Napipi. It was represented to him that between this part of the coast and the valley of the Atrato the chain of the Andes is entirely broken, and on this point he quotes the authority of an intelligent Biscayan pilot. A number of other authorities are cited by Fitz Roy, particularly Lieutenant Wood, Royal Navy, and Captain Illingsworth, (Journal Royal Geographical Society, 1851, p. 178,) who give color to the correctness of this statement by circumstantial facts; and, in addition to all this, the opinion is so current in the country that the native Indians are in the habit of passing, freely and without difficulty, between the Pacific coast and the tributaries of the Atrato, that it probably has some better foundation than we are aware of.

Acting upon these reports, Mr. Kelly fitted out two other expeditions in the year 1854, one of which, under Mr. Lane, was despatched to the Truando, and the other, under Mr. William Kennish, was directed to commence operations on the side of the Pacific. Mr. Kelly's instructions to Mr. Kennish were drawn up in accordance with the preceding information. He was to follow the coast from Point Garachine southward to 7° north latitude, (Cupica bay is 6° 41′ 19″ north,) and to look for any depression in the range of the Cordillera which held out the prospect of an open cut without resorting to locks, and on observing any such place, he was to institute a thorough survey, for which the means and instruments were provided.

Mr. Kennish, after passing the bold and mountainous region to the northward of Punta Ardita, met with a remarkable depression opposite that portion of the coast which lies to the southward of that point, and between it and Punta Marzo. Mr. Kennish says in his report: "In this interval the country loses its mountainous character entirely, and assumes the appearance of a gradual rise or slope, with hills of little elevation in the distance."

Opposite this depression of the Cordilleras, he discovered an inlet not before described, but now known as Kelly's inlet, affording convenient shelter and anchorage, into which the Paracuchichi empties its waters.

Encouraged by these favorable conditions, and by the best information he could obtain from the natives, he determined to cross from that point to the Atrato by the shortest course. The party, following the course of the streams on the west of the water-shed, crossed the summit at a height of five hundred and forty (540) feet, and descended over a series of falls to the Nerqua, a tributary of the Truando, along which rivers they proceeded to the Atrato. The information furnished by Mr. Kennish's survey, particularly tending as it did to strengthen the previous reports of Humboldt and other travellers, was received everywhere with attention.

In England, the subject was taken up by the Royal Geographical Society and by the Institution for Civil Engineers, and freely discussed in all its bearings. In the United States the government thought it worth while to ask for a special appropriation to defray the expenses of an expedition to the same region for the purpose of verifying Mr. Kennish's explorations.

This expedition was placed under the direction of Lieutenant (now Brigadier General) Michler, of the engineers, and Lieutenant (the late lamented Commander) T. A. Craven, United States Navy; the hydrographic work being assigned to the latter, and "the explorations and verification of surveys already made near the isthmus of Darien to the former." The reports of Mr. Kennish were confirmed in all essential particulars; but beyond this—and what, perhaps, is more important—General Michler's work was conducted with all the

Digitized by Google

advantages which the best instruments and the most thorough education can confer. His topography and his levels furnish us with a complete representation of this region, reliable in all its details, and not subject to any of those painful doubts which belong to mere reconnoissance or primary exploration. It is in the highest degree satisfactory to know precisely what we are to expect in this part of the Cordilleras, which has given rise to such ardent hopes in the minds of numerous writers and explorers, from Humboldt and his native correspondents, who first drew his attention in this direction, down to Kelly and Michler. General Michler, it is very interesting to know, is struck with the same promising but deceptive appearance of the mountain range when viewed from the ocean. He says: "In looking back from the ocean upon the country through which the party recently travelled, the depression in the Cordilleras becomes plainly visible. It seems, in reality, to lose the mountainous character entirely, and assumes the character of a gradual rise or slope, with hills of little elevation in the distance. The dense growth of timber which mantles the crests of the hills make the resemblance to a low flat region still more apparent; and when beheld from a little distance out at sea the view must be still more strikingly so. One can easily, therefore, conceive why a preference should have been shown to this section by those interested in explorations of a route for a ship canal." (Report, p. 93, Ex. Doc. No. 9, 36th Cong., 2d sess., Senate.)

The annexed sheets, numbered XI and XII, contain the map and profiles of General Michler's line of survey, from the mouth of the Truando to Kelly's inlet. This map, studied in connection with his itinerary, (pp. 49-99, *ibid.*,) will make the reader thoroughly acquainted with this now celebrated isthmus of Choco, not only with the physical geography, geology, natural history, &c., but with the mode of travel and the manners and customs of the people.

Both Trautwine and Michler have, through their experience, given us some important lessons upon the conduct of expeditionary parties in these regions. Both of these gentlemen were, in spite of their best precautions, exposed to considerable hardship and privation. (See their reports, *passim.*) I should fail to profit by these lessons if I were not to point out the necessity for providing all future surveying and exploring expeditions with provisions in a concentrated form. This is a matter not to be overlooked.

Before concluding this branch of the subject, I must not omit to mention an important point in which Trautwine and Michler fully concur, and that is, the docile and tractable character of the native Indians. Neither of them had any difficulty in securing aid, and never failed to receive from them kindness and good will. "I never," says Trautwine, "in all my New Granadian experience, felt myself to be among ruffians. Among the Indian tribes through which I passed, I laid aside my pistols and armed myself with a pocketful of cigars. A present of an empty sardine box was more effective than a two-edged sword; and a lump of sugar to a papoose was a better passport than my government could afford."

The greatest regret was experienced by General Michler in being compelled to part with two of his native assistants who had been long with him. These statements must be understood, however, to apply to the Indians of the valley of the Atrato, and not to those of the isthmus of Darien proper.

CONCLUSION.

We get the idea of the value attached to the construction of a ship canal across the American isthmus—"the mightiest event, probably, in favor of the peaceful intercourse of nations which the physical circumstances of the globe present to the enterprise of man"—from the character of the minds which have taken an interest in this scheme, as well as from the number of projects which have been offered for its fulfilment. Among the governing minds of the world which have recognized the consequences to the welfare of mankind with which

Digitized by Google

this undertaking is pregnant, may be mentioned that of Pitt. It will be remembered by the readers of diplomatic history that the plan for the emancipation of the Spanish colonies from the mother country, which was drawn up by Miranda and his associate deputies and commissioners and presented to the British government, contains in the sixth article a stipulation for the opening of navigation between the Atlantic and Pacific oceans by the isthmus of Panama, as well as by Lake Nicaragua. This document is dated Paris, December 22, 1797. Mr. Pitt entered with promptness into the scheme.

So, also, our own Jefferson bestowed his thoughts and interest upon this subject, as may be seen in more than one of his letters to Mr. Carmichael.

In one of them, dated Paris, May 27, 1788, he says: * . * "With respect to the isthmus of Panama, I am assured by Burgoine that a survey was made and a canal appeared very practicable; but the idea was suppressed for reasons altogether political. He has seen and minutely examined the report. This report is to me a vast desideratum, for reasons political and philosophical." * . * (Jefferson's Works, vol. 2.)

I have spoken of the number of projects which have been offered to the world. Including canals and roads they amount in all to twenty-six, (26,) as shown by the following tables, taken principally from Malte Brun, (fils.)

TABLES.

CANALS.

I				1. Tehuantepec, by the Coatzacoalcos and Chicapa.
II				2. Honduras.
III.	River San Juan de Nicaragua.			3. R. San Carlos, G. de Nicoya.
		Lake Nicaragua.		4. R. Niño, Tempisque, G. de Nicoya.
				5. R. Sapoa B. Salinas.
				6. San Juan del Sur.
				7. Brito.
			L. Managua.	8. R. Tamarinda.
				9. P. Realejo.
				10. B. Fonseca.
IV...Panama			R. Chagres.	11. Gorgona, Panama.
				12. Trinidad, Caymito.
				13. Navy Bay, R. Chagres, R. Bonito, R. Bernardo.
				14. San Blas, R. Chepo.
V .... Darien				15. B. Caledonia, G. San Miguel.
				16. Rs. Arguia, Paya, Tuyra, G. San Miguel.
			Rio Atrato.	17. R. Napipi, Cupica.
				18. R. Truando, Kelley's I.
				19. R. Tuyra, G. Urabá or R. Atrato.

ROADS.

I.—Coatzacoalcos, Tehuantepec.
II.—B. Honduras to G. of Fonseca.
III.—R. San Juan, Nicaragua, Managua, G. of Fonseca.
IV.—Port Limon to Caldera, Costa Rica.
V.—Chiriqui inlet to Golfo Dulce.
VI.—Aspinwall, Panama, (railroad finished.)
VII.—Gorgon B., Realejo. } Nicaragua.
VIII.—Gorgon B., San Juan Del Sur. } Nicaragua.

Digitized by Google

I have adopted Malte Brun's general classification as being in fact the natural one. It begins with Tehuantepec and ends with Darien and the Atrato. I have, in the preceding pages, considered each one of these general lines separately, and presented an accurate profile, and in some cases both map and profile of each, on a scale sufficiently large to be perfectly intelligible. Ample data are furnished for estimating distances, heights, summit levels, and locks, where locks form part of the plan; and, in general, for answering all the inquiries of the resolution. I have reported upon "their relative merits as practicable lines for the construction of a ship canal," and it now remains for me to express an opinion whether "the isthmus of Darien has been satisfactorily explored."

The isthmus of Darien has not been satisfactorily explored. With the exception of the line of survey from Chepo to San Blas, the knowledge of which, through the kindness of Mr. Kelly, is first given to the world in this report, and with the exception of the explorations of Prevost and Gisborne, and the solitary and unrecorded, and therefore unsatisfactory journeys of Dr. Cullen,* the interior of the Isthmus of Darien, east of the Panama railroad, is almost a *terra incognita.*

Strange as it may seem, when it is considered that this is the part of the continent first settled, and that it has always commanded the greatest attention on account of this very question now before us, yet it is strictly true, with the exceptions above, that the best knowledge we possess of the isthmus is dsrived from the journals of Dampier and his companions, from the reports of Paterson, and from the brief journal, already quoted, of Milla.

There does not exist in the libraries of the world the means of determining, even approximately, the most practicable route for a ship canal across the isthmus. Our really authentic information amounts to this—that at that part of the American isthmus where the oceans approach each other, nature has supplied harbors of unsurpassed excellence on both sides, and navigable rivers that invite the traveller to penetrate into the wilderness; while on one side she has established a tidal condition in the highest degree favorable to the needs of a commerce which traverses the great seas. In the immediate neighborhood of this isthmus is a country (of which it forms a part) possessing features that give it eminence among the nations. It has good ports on the Atlantic and Pacific oceans; it is mistress of the isthmuses of Panama and Darien, which already enjoy great importance in the world's commerce, and are destined hereafter to acquire still more; it has great agricultural resources; while in its physico-geographical structure it embraces valleys traversed by noble rivers; table-lands, at different elevations, that afford a variety of climate and productions; and mountains in which still lies buried an incalculable amount of mineral wealth, and at the foot of which the native Indian, with the rudest means and appliances, collects, in a few hours, gold enough to enable him to pass weeks or months in indolence and diversion.

It is to the isthmus of Darien that we are first to look for the solution of the great problem of an interoceanic canal. We know enough of the interior topography to adopt the view of Dr. Cullen, that if we leave the Indian trail, which always passes over the highest ground, and explore the country beyond the ordinary line of travel, we shall probably find a valley transversely dividing the Cordilleras, or at least a lower ridge than any yet surveyed. Our most trustworthy engineers in these regions, Trautwine, Michler, Prevost, McDougal, and others, tell us that it is impossible, from the very limited inspection of the country taken on the Indian line of travel, to form any conception of the nature of the ground even in the immediate vicinity. This is owing to the unbroken forest of heavy timber, of which Paterson gives an idea in the first letter to the directors, in the following words: "The hills are clothed with tall trees without any underwood, so that one may gallop conveniently among them many miles,

* Not only unsatisfactory, but it is my duty to say, even doubtful.

Digitized by Google

free from sun and rain, unless of a great continuance."—(Dalrymple, *ubi supra.*) But there is also abundant evidence in the accounts of our most recent explorers that there is to be found, in many places, a dense and tangled underwood, which admits of no progress except by removal. The future surveyors must, therefore, go prepared to encounter this as well as other difficulties. There are two provisions which appear to me indispensable in future expeditions:

First, rations, in a concentrated and portable form, to enable the surveyors to prosecute their investigations at leisure.

Secondly, the means of removing the undergrowth and clearing the way for pioneers; and for this latter purpose a corps of native Indians may be employed with their *machetes*, and fire may be resorted to, as suggested by Fitz Roy.

I have added to this report some statistical tables, (Appendix No. I,) derived almost entirely from Mr. Kelly's publications, showing the advantages of this canal, so far as those advantages can be displayed by statistics merely. Statistics, however, constitute the framework which, to be correctly understood, must be filled up with all that creates symmetry, progress, and life. Besides, these figures are necessarily limited to the existing state of traffic and intercourse, or, rather, to that which did exist before the commerce of the country was disturbed by the rebellion.

If the distance between the nearest continent and the most ancient seat of human life were diminished by one-half, and if, in addition to this, the voyages between the two hemispheres were rendered much less hazardous and difficult, such an interchange of their production and labor would take place as it is now impossible to imagine. Already the remote colonies of Australia and New Zealand are eager to profit by the advantages of this newer and shorter line of communication. In 1863, the postmaster general of New Zealand arrived in England empowered to offer £30,000 per annum, from the 1st of January, 1864, for four years, as a contribution toward carrying out a steam line *via* the Central American isthmus. New South Wales agreed to vote £50,000 sterling per annum for the same service.* (Pim., p. 374, note.)

It is from a like point of view that we are led into the contemplation of the grandeur of the project for uniting the two oceans. But as a consequence of its importance and general interest to the commerce of the whole world, it is our duty to collect and collate all authentic information before proceeding to the execution of such an undertaking. We must remember that we are about to construct a work that not only must satisfy the necessities of the moment, but must be suited to meet the wants of the future, and be useful to all coming ages.

The interoceanic canal, in width, depth, in supply of water, in good anchorage and secure harbors at both ends, and in absolute freedom from obstruction by lifting locks or otherwise, must possess, as nearly as possible, the character of a strait. It may be thought premature to say that the time has arrived for its execution. But it will not be denied that the present opportunity is the most favorable that could possibly arise for conducting, on our part, the preliminary surveys without interruption, interference, or unwelcome participation.

A list of the principal authorities relating to projects of interoceanic communication through the American isthmuses is appended hereto for the convenience of those who may have occasion to look into this subject either more fully or more comprehensively than is consistent with the prescribed limits and objects of this report.

C. H. DAVIS,
Rear-Admiral, Superintendent.

UNITED STATES NAVAL OBSERVATORY,
Washington, D. C., July 10, 1866.

---

* While this report is passing through the press we see that a new line of mail packets, subsidized by the government of New Zealand, has been established between Panama and Wellington, making monthly departures from Panama about the 24th of each month, or on the arrival of the mail from Southampton.

Digitized by Google

ADDENDA TO THE EDITION ORDERED BY THE SENATE RESOLUTION OF FEBRUARY 9, 1867.

UNITED STATES NAVAL OBSERVATORY,
March 14, 1867.

The present edition of the report on interoceanic railroads and canals has received the valuable addition of an old Spanish map based on surveys executed between the years 1780 and 1790, accompanied by a descriptive memoir, in the form of a report, from the Governor of the Province, by whom the surveys were made.

The existence of such a map was communicated some time ago to Major General R. Delafield, at that time Chief Engineer of the army. The present copy was obtained through Hon. J. P. Hale, our minister at the court of Madrid, by the Hon. William H. Seward, Secretary of State, at the request of General Delafield. It has just been received, and I am permitted by Major General A. A. Humphreys, now Chief of Engineers of the army of the United States, to whom I am under great obligation for this favor, to add the map and descriptive memoir to this edition.

In order to preserve all the evidences of its authenticity, I present this map precisely in the form in which it came into my hands, without any change whatever—without even the translation of the title; the latter is, however, translated in the descriptive memoir.

A few remarks will serve to call the attention of the reader to the character and objects of this map, and to point out several details of special interest. I shall pursue here the rule laid down in the beginning of this report, of confining myself strictly to its subject-matter. Accordingly, without entering into historic details the most important of which will be found briefly stated in Fitz Roy's second memoir, and all of which will be found at length in the valuable essay of M. Chevalier. I will content myself with reminding the reader that notwithstanding Darien was the seat of the first Spanish settlement, and notwithstanding the pains taken from time to time to multiply and strengthen their position, yet the Spaniards were never really masters of this particular isthmus. They built strongholds, they increased the number of their colonists, they opened mines, they introduced missionaries, and they covered the coasts with their men-of-war; still they never arrived at complete and undisputed possessin of the whole isthmus. Not only were they harassed by the continual incursions of the buccaneers and the English roving cruisers, but they were compelled to maintain constantly renewed hostilities with the aboriginal tribes dwelling along the northern coast, on the Cordilleras, and in the valley of the Chucunaque. These aborigines are called, in the Spanish documents, Chucuna and Chucunaque Indians, and are distinguished in our day by the title of *bravos*. This warfare was raging when Don Andrcs de Ariza was appointed Governor of Darien, and established the military post of Fuerte del Principe.

The following description of the province of Darien or Great Golden Castile, and the appended map of which it is an explanation, are the results of the official labors of Governor de Ariza, performed under the orders of his excellency the viceroy, Don Manual Flores, in the year 1781. The character of the map and memoir corresponds to the political state of the country. It is a military map, and treats of military events; it marks the sites of fortified places, of garrisons, and of Indian incursions; it describes military movements, and treats at length of the means of general defence of the whole province, and of the measures necessary to restrain or repel the assaults of the savages.

It bears its official stamp on every part of it in its historical and topographical details, as well as in its precise statistics of population and production. The recital of the frequent massacres that had recently taken place reveals the actual

Digitized by Google

condition of things, and, at the same time, supplies internal evidence of the care and fidelity with which the author executed his task.

The same may be said of the cross-roads and of the descriptive enumeration of so many different places. One or two of these descriptions whet our curiosity, and excite the wish that our author had added a few more words of explanation. When he announces in his account of the cross-road A A, the discovery of "the narrow neck which divides the port of the Caledonia on the north from that of the Savana on the south," we feel an eager desire to see the door, to which he has barely pointed, opened wide. His description of the road C. C. C. C, as "level, and suitable for wheels as far as the mouth of the Sucubti," whence "it is easy to cross to the coast with beasts of burden;" and of the portage or slope *h'' h''* from the river of "Balsos to the river Jurado, by means of which small canoes pass from one river to the other;" and the subsequent enumeration of the passes from the foot of the Cordilleras on one side to the plains on the other, all point out to us the scenes of future explorations, and encourage the hope that in some one of these localities we may discover the very object of our ardent longings.

Ariza in some of these passages is so near to important developments, and yet so reticent, that his conduct seems to require some explanation; and we think we may find that explanation in the peremptory interdiction by the Spanish government of any allusion to or discussion of a project of an interoceanic water communication.

This interdiction is contained in the decree of Philip II, referred to by Alcedo in his Geographical and Historical Dictionary of the West Indies, (see Fitz Roy's Jour. R. Geog. Soc., vol. xxiii,) I am not aware that it was removed during the control of the Spanish government. For further information on this point, and on the "Secret du Détroit," see Humboldt, E. P; Revue des Deux Mondes, 1844; L'Isthme de Panama, par Michel Chevalier; and Annales des Voyages, 6me, série 9, 10; "Differents Projets," &c., par V. A. Malte-Brun.

This concludes all I have to say at present concerning the details of the map and memoir and their mutual correspondence. I have added to the border of the map a sketch of a route suggested by Ariza's map, and recommended for special investigation.

C. H. DAVIS,
Rear-Admiral U. S. N., Superintendent.

Description of the province of Darien, or Great Golden Castile, being an explanation of the map of the interior of this province, and of the new discoveries made by the Governor, Don Andres de Ariza. Reduced and revised by him by order of his Excellency the Viceroy, Señor Don Manuel Antonio Flores, in the year 1781.*

The village of Yavisa is the capital of the province, and contains a fort in which reside the governor and a garrison of eighty men. It was built in the year 1760 to restrain the incursions of the savage Indians of Chucunaque, which were put a stop to by this means.

The village of Darien, or Santa Maria de la Antigua, was the capital in this year 1760. It contained, at the most, three hundred and eleven inhabitants and a fort with a garrison of six men. It is the depot of the canoe trade, and is at present the place most conveniently situated for this purpose.

---

*General Office of Achives in Saville.

This map and description is copied from the originals contained in a package marked "council of Panama." Despatches relating to "Darien and Caledonia from the year 1772 to the year 1787," found in the portfolio marked "general plan of the isthmus accompanying the annexed despatch of the year 1786."

Digitized by Google

The village of Cana was, at the beginning of this century, the richest and largest one in the province. It is now reduced to seventy-eight inhabitants, at the most, including twenty who compose the garrison of the fort. The temperature is cool, and the rich mines of Espiritu Santo are situated in this vicinity.

The village of Fuenty is composed of one hundred and eighty-five inhabitants, at the most. South of it extend the mines of Froncoso and many others.

The fort of Chapigana, and village of the same name, comprise a family of twenty-five men.

The fort of Setegante contains a garrison of twenty men. It was built in that place in the year 1779, to restrain the incursions which the before-mentioned savages of Chucunaque made upon the trading canoes.

The fort of the island of Boca Chica has a garrison of twelve men. It was attacked while under construction, in the year 1777, by more than eighty of these savage Indians of Chucunaque, who were repulsed by eight soldiers, only, who came to the aid of the workmen.

This island of Boca Chica is about two miles long and less than one broad; is very conveniently situated for a fortified city; enjoys a cool and healthy climate; and is the entrance to the whole interior of the province. There is no other available passage or accessible place by which the armies of the Crown can make an attack on account of the extensive mangroves that overrun the shore which is not mountainous or rugged.

All the rivers which fertilize the province on this side of the Cordilleras discharge themselves in this place through two passages. There are two extensive bays: one within the river, more than ten miles long and three broad, and the other outside, of the same dimensions, more or less, where vessels of war can anchor under the protection of the guns.

Both inside and outside, at the same distance, there are other islands of agreeable aspect and admirable proportions suitable for powder magazines, and other buildings such as ought to be placed beyond the risks of a town.

Within these bays are found stone quarries and timber adapted for large works; and in one word this is the spot to which, on account of its situation and surroundings, the Government should devote its whole attention if it wishes to preserve this valuable isthmus.

The province possesses two avenues of hostile approach: one, the Boca Chica just mentioned; the other, Caledonia bay, which, in my opinion, is no less exposed. It seems to me that there is no other country in the world better protected from attacks or landings, and if it were suitably fortified at each of the before-mentioned avenues two thousand men could repel a force of more than twenty thousand; and if the enemy should fail to make himself master of both posts at the same time he would not be able to communicate between the two seas. It is true that a superior force might effect a landing in the gulf on the north or inside of the Mulata islands, but to undertake to get possession of the general Cordillera through any other point than Caledonia bay would be an act of rashness that would surely meet with punishment.

One natural feature very much to be admired is the narrowness of Boca Chica on approaching it; and in the summer season, in which the river has no freshets, a certain music is heard continually at the bottom of the passage, which the natives call the organs; and throughout the whole of this locality an extended organ, as it were, is heard, played below, the sound of which is very pleasant, and at the same time the water seems to boil, sending up bubbles which break away from the bottom, and encounter the boat without being seen. I have observed this very particularly, and my only conclusion has been that the bed of the river, which is rocky in that part, is like a sieve, and that some aerial current breathes through the holes, and, playing upon the water, causes this sound.

The village of Pinogana contains two hundred and four inhabitants, most of them friendly Indians, who, a short time ago, became converts. They are

Digitized by Google

much devoted to agriculture, and gather large quantities of plantain and some cocoa.

Molineca contains eighty inhabitants, most of them the same Indians.

Fichiche contains one hundred and thirty-eight inhabitants, most of them these very same Indians; and each of these villages contains large canoes, used in exporting their fruits to Panama.

1. *The creek of the graceful turn.*—In this creek, in the month of October, 1778, the Indians of the Chucunaque lay in ambush, and with a squadron of eight pirogues made a sudden attack upon two canoes from Fichiche; these, however, combined the crews of both in one, and, with five muskets, forced a passage and cleared themselves from the Indians, who were more than eighty in number.

2. *The locality of Chapigana.*—Here the same Indians, in the year 1777, killed or carried off alive an inhabitant of this village.

3. *The creek of Setegante.*—Here the same Indians lay in ambush in the month of July, 1778, and, with the same squadron of pirogues, seized a canoe which was going to Panama, laden with fruit, killing at the river one of the men who had not the courage to escape with the rest of the crew.

4, 5, 6, 7, 8. *Farms* (haciendas) at the entrance of the province which are in ruins from incursions by the same Indians.

9. *The river Congo*, the population of which was massacred in the year 1768 by these very Indians, from which time this beautiful country has remained a wilderness.

10. *Port Ypelisa.*—Its garrison, consisting of five men, was massacred in the same year (1768) by the same Indians of Chucunaque, who came from Caledonia, along the coast as far as the villages at the marshy ground of Tigre and Arguilla, and invited the Indians of that vicinity to take part with them, which the latter refused to do except so far as to allow them to pass.

The Caledonians, after having done the mischief, retired by a different route; heading several rivers, and descending the Chucunaque, they were attacked incidentally by the friendly Indians of Ficheche, who were not able to inflict any other injury than to deprive them of a small boat containing the spoils of arms and tools which they had plundered from Ypelisa; these were kept in Ficheche to assist the transports from Cana.

11. *River Fayequa or de la Marca.*—The population was massacred in the year 1774 by the same Indians of Chucunaque. The mineral streams of Bagre are situated in this depopulated vicinity.

12. *The river of Yavisa.*—Its population, composed of friendly Indians, was massacred in the year 1756 by these same rebels, and afterwards in 1772 they placed an ambush at the mouth of the river to kill my predecessor, Bobadilla, who was in the habit of going to bathe there; he omitted it on that day on account of its being St. Joseph's day. But the savages exercised their cruelty by killing a female servant and a soldier of the garrison, and they carried off a girl, who is now in Tamanaca. This river was depopulated by these events.

13. *Point Muchutubugu.*—This was cut through in the year 1779 to shorten the navigation of the river, and to remove certain favorable circumstances of which the Indians availed themselves. When pursued they were in the habit of placing here their advance sentinels.

14. *Port of Laloma,* in the river Chucunaque, occupied to prevent the passage of the English during the present war. This was burned by the Indians of the river, in the month of October, during the past year, and has ever since been abandoned.

a. a. Pass or cross-road, followed by these Indians in their attack on this last place, which was unknown until discovered in the sortie of the month of March,

Digitized by Google

of this year, when, fortunately, was also found the narrow neck of this part of America which divides the port of Caledonia on the north from that of the Savana on the south.

b. b. b. b. Cross-road, which the savages of Chucanaque made use of to carry on their hostilities at the entrance of the province, in the light boats mentioned before. These boats were constructed in the creek of Yglesias. I broke them up in December, 1779, up to which time the road had been unknown to us. Since then their hostilities have ceased, but the inhabitants of this province were so terrified that they were eager to abandon it, and would have done so if I had not exerted myself personally to deprive the Indians of this force.

C. C. C. C. A road recently discovered leading from the port of Savana to that of Caledonia. It is level, and suitable for wheels as far as the mouth of the Sucubte, and from here it is easy to cross to the coast with beasts of burden.

C a. District of Coco Bolo, where the wood has been recently cut by the savages. From this point, I corrected the return route from the mouth of the Sucubte.

d. d. Short cut from the bend of Tupira to the islands of Fichiche—a journey of two hours.

e. e. e. e. Short cut from Yavisa to the villages of Pinogana and Molireca. It has been mentioned three times that the savages carried on hostilities against these towns through these paths before the village and fort of Yavisa were erected as a defence.

f. f. f. f. Path from the village of Darien to Cana. This is a journey of two days, in which are encountered many small rivers intercepting the way, especially the river Cupe, which in its various turns is passed sixteen times. The journey is not, however, interrupted by the freshets, which are drained off as rapidly as they accumulate.

g. Plantation, or rocky notch, whence the great river of Tuqua issues and begins its lower course.

h. h. Cross-road, or portage, discovered in the year 1777, from the river of Balsos to the river Jurado, by means of which small canoes pass from one river to the other to travel along the coast of Choco and to the new port of Cupeca; they are not able to make the usual voyage in the winter on account of the rapidity of the currents and the roughness of the sea.

Rivers which facilitate the crossing of the Cordillera from the south to the north.

The Arquali affords a pass to Navigandi on the coast of Caledonia; the Yublugande, for the same; the Sucubte, to Caledonia; the Chuety, the same; the Tuquesa, to the beach of Caresand to Armira; the Tupisa, to the river Gande; the Yavisa, to the Tarena and to Cuty; the Puero and Paya, to the marshes of Tigres and Arquilla; the Penusa, to Yoo, Cacarica and Motete; the Moleti, to Sasardi.

The headwaters of the Chucunaque spread themselves over level ground, and approach a branch of the Chepo, so that small canoes pass from one to the other by means of a portage which divides them. The flood-tide ascends the rivers of this province up to the points marked +, which is very convenient for transports regulating their journey by the periods of the tide. The tidal currents are very strong in these rivers, being equal to any freshet, and accordingly it is said that the rivers of this province run up further than their natural limits.

In general, the rivers that receive the tide overflow their banks more or less, according to their proximity to the sea.

All the rivers which fertilize the soil are without tide, and are remarkable for their being covered with all sorts of timber from their very mouths.

This country abounds in woods suited for public works and dwellings, and the materials are easily transported from the mountains, through the numerous creeks,

Digitized by Google

ravines, and rivers which empty into the principal streams. Wherever the tide enters, large vessels of the size of frigates can be built with facility, and launched from the stocks without the expense of ways, solely by the help of the tide, which rises more than three fathoms, (toises.)

All these mountains and river valleys are, in general, full of native gold ores, particularly the mountains of Espiritu Santo, from which it has been taken in such abundance as to be measured by the half bushel, and weighed by the hundred weight.

Although the territory of the province is somewhat mountainous, it has, nevertheless, extensive valleys on both sides of the Cordilleras, which is here, for the most part, narrow, and of little elevation; the climate is good, and the fertility of soil excellent for cultivation or grazing.

All the rivers, river mouths, and marshes, which are numbered for reference in the text, are enlarged for practical uses, and are not in themselves mathematically correct. The red numbers on the Indian rivers denote the number of men able to bear arms (armas) in each case. The black figures denote the number of cocoa trees in the year 1761.

ANDRES DE ARIZA.

YAVISA, *October* 28, 1781.

There is a sign manual.

Iph: Dias Pedregal.

DIAS PEDREGAL.

APPENDIX No. I,

Containing several tables compiled by Mr. F. W. Kelly, and designed to present a general view of some of the immediate results of a canal through the isthmus.

Table of the saving in distance from New York to the following places, by the isthmus of Panama, over the Cape routes.

From New York to—	District *via* Cape of Good Hope.	Distance *via* Cape Horn.	Distance *via* the Isthmus of Panama.	Saving in distance over the route by Cape of Good Hope.	Saving in distance over the route by Cape Horn.
	Miles.	*Miles.*	*Miles.*	*Miles.*	*Miles.*
Calcutta	17,500	23,000	13,400	4,100	9,600
Canton	19,500	21,500	10,600	8,900	10,900
Shanghai	20,000	22,000	10,400	9,600	11,600
Valparaiso	....	12,900	4,800	....	8,100
Callao	....	13,500	3,500	....	10,000
Guayaquil	....	14,300	2,800	....	11,500
Panama	....	16,000	2,000	....	14,000
San Blas	....	17,800	3,800	....	14,000
Mazatlan	....	18,000	4,000	....	14,000
San Diego	....	18,500	4,500	....	14,000
San Francisco	....	19,000	5,000	....	14,000
Wellington, N. Z.	13,740	11,100	8,480	5,260	2,620
Melbourne, Australia	13,230	12,720	9,890	3,340	2,830

Digitized by Google

Table showing the trade of the United States that would pass through the isthmus canal, if now finished; taken from the official returns for the year 1857.*

Countries traded with.	Exports and imports.	Tonnage.
Russian North American possessions	$126,537	$5,735
Dutch East Indies	904,550	16,589
British Australia and New Zealand	4,728,083	52,105
British East Indies	11,744,151	177,121
French East Indies	98,432	3,665
Half of Mexico	9,601,063	34,673
Half of New Granada	5,375,354	131,708
Central America	425,081	36,599
Chile	6,645,634	63,749
Peru	716,679	193,131
Ecuador	48,979	1,979
Sandwich islands	1,151,849	33,876
China	12,752,062	123,578
Other ports in Asia and Pacific	80,143	4,549
Whale fisheries	10,796,090	116,730
California to east United States†	35,000,000	861,698
Value of cargoes	100,294,687	1,857,485
Value of ships, at $50 per ton	92,874,250	....
Total value of ships and cargoes	193,168,937	92,874,250

* Congressional Reports on Commerce and Navigation. † Exclusive of gold dust.

Whale ships and coasting vessels have been estimated generally throughout this Appendix at forty dollars ($40) per ton. The United States and European commerce around the capes is conducted in first-class ships, which often cost eighty dollars ($80) per ton; fifty dollars ($50) have therefore been taken as the fair average value in the construction of this table, which does not include coasting trade.

Table showing the trade of England that would pass through the isthmus canal, if now finished; taken from the official returns for the year 1856.

Countries traded with.	Exports and imports.	Tonnage.
Half of Mexico	$2,775,137	$11,833
Half of Central America	1,244,817	5,615
Half of New Granada	2,437,605	10,188
Chile	15,486,110	118,311
Peru	20,473,520	244,319
Ecuador	360,015	1,820
China } Outward: only 40 days saved by canal	7,077,390	68,530
Java } Outward: only 40 days saved by canal	3,821,410	16,003
Singapore } Outward: only 40 days saved by canal	4,364,070	16,500
Australia and New Zealand	78,246,095	522,426
Sandwich islands	520,560	1,950
California	2,378,105	11,800
Value of trade	139,184,834	1,029,295
Value of ships, at $50 per ton	51,464,750	....
Total value of trade and ships	190,649,584	51,464,750

Digitized by Google

Table showing the trade of France that would pass through the isthmus canal, if now finished; taken from the official returns for the year 1857.

Countries traded with.	Exports and imports.	Tonnage.
Chile	$10,000,000	$25,688
Peru	13,160,000	35,096
Half of Mexico	2,790,000	10,004
Half of New Granada	1,090,000	2,389
Ecuador	440,000	1,651
Bolivia	100,000	1,000
California	2,073,859	8,997
China } Outward only	2,180,000	2,028
Dutch East Indies } Outward only	4,440,000	20,400
Sandwich islands	2,000,000	4,119
Philippine islands	1,000,000	1,463
Australia	19,800,000	50,000
Value of cargoes	59,073,859	162,735
Value of ships, at $50 per ton	8,136,750	....
Total value	67,210,609	8,136,750

Table showing the total tonnage that would pass yearly through the isthmus canal, if now finished; from official returns.

	Tons.
United States	1,857,485
England	1,029,295
France	162,735
Other countries	44,555
Total	3,094,070

Table showing the general results of the foregoing tables.

Tonnage and trade of	United States	$193,168,937
Do.	England	190,649,584
Do.	France	67,210,609
Do.	Other countries	16,802,000
Total trade affected by the canal		467,831,130

Table showing the saving in money to the trade of the United States that would result from the use of the isthmus canal; according to the official statistics for the year 1867.

Insurance on vessels and cargoes saved	$3,863,378
Interest saved on cargoes	3,008,840
Saving of wear and tear of ships, five per cent	4,643,712
Saving of freight money, (by time)	11,250,000
Saving of wages, provisions, crew, &c	13,230,000
Total yearly saving to the United States	35,995,930

Digitized by Google

Table showing the yearly saving in money to the trade of England, as ascertained by the official returns for 1856, *if the trade passed through the isthmus canal instead of round the capes.*

Insurance on vessels and cargoes	$1, 906, 495
Interest on cargoes	1, 858, 826
Saving of wear and tear of ships	2, 573, 237
Saving of wages, provisions, &c	3, 611, 790
Total yearly saving to England	9, 950, 348

Table showing the saving in money to the trade of France that would result from the use of the isthmus canal; according to the official statistics for the year 1857.

Insurance on vessels and cargoes	$753, 000
Interest saved on cargoes	452, 084
Saving of wear and tear of ships	325, 470
Saving of freight money, estimated by time	276, 949
Saving of wages, provisions, and outfit of ships	376, 427
Total yearly saving to France	2, 183, 930

Table showing the saving to the trade of the world by using the isthmus canal.

United States	$35, 995, 930
England	9, 950, 348
France	2, 183, 930
Other countries*	1, 400, 000
Total	49, 530, 208

Exports of Great Britain increased one hundred and seven per cent. in ten years. Exports of France increased one hundred and thirty per cent. in ten years. Exports of the United States increased ninety-three per cent. in ten years. If the trade increases one hundred per cent. in the next ten years, the saving to the world will then be ninety-nine millions sixty thousand four hundred and sixteen dollars ($99,060,416) per annum.

APPENDIX No. II.

Table showing the articles prepared for the report on interoceanic communication, in answer to the resolution of the Senate of the United States of March 19, 1866.

No. I. General map of the American isthmuses, showing the various lines proposed for interoceanic communication; compiled by Rear-Admiral C. H. Davis, United States navy, Superintendent United States Naval Observatory; July, 1866.

* Equated from the trade of England, France, and the United States.

Digitized by Google

No. II. Profiles of the isthmus of Tehuantepec, taken from surveys made under the direction of J. G. Barnard, colonel United States engineers, 1851; J. W. Williams, principal assistant.

No. III. Map and vertical section of the proposed Honduras interoceanic railway, located 1857–'58; Squier, Trautwine, Jeffers.

No. IV. Map and profile of the route for the construction of a ship canal from the Atlantic to the Pacific ocean across the isthmus in the State of Nicaragua, Central America; surveyed for American Atlantic and Pacific Ship-canal Company by O. W. Childs, 1850–'51.

No. V. Map of the isthmus between Chagres and Panama; by Chief Engineer Napoleon Garella, 1845.

No. VI. Survey for Panama railroad; Colonel G. W. Hughes, 1849.

No. VII. Map and profile of the route for the construction of a ship canal between the Pacific and Atlantic oceans; A. McDougal, chief engineer; C. A. Sweet, J. E. Forman, and N. Rude, assistants; 1864. (Surveyed for Mr. F. M. Kelly.)

No. VIII. Isthmus of Darien; map showing the routes of Prevost and Gisborne; 1854.

No. IX. Map of part of the isthmus of Darien, by Dr. Cullen; 1853.

No. X. Map of an exploration for an interoceanic canal by way of the rivers Atrato and San Juan in New Granada, South America; laid down from observations made by J. C. Trautwine, civil engineer; 1852.

No. XI. General sketch of the surveys for an interoceanic ship canal near the isthmus of Darien, *via* the rivers Atrato and Truando; Michler, 1858–'59.

No. XII. Interoceanic ship canal, *via* the Atrato and Truando rivers; Michler, 1858–'59.

No. XIII. Isthmus of Darien from 77° 20′ to 80° 10′; compiled at the United States Naval Observatory from various authorities, including maps of 1764; 1865–'66.

No. XIV. Description of the province of Darien, or Great Golden Castile, being an explanation of the map of the interior of this province, and of the new discoveries made by the governor, Don Andres de Ariza. Reduced and revised anew by him, by order of his excellency the viceroy, Señor Don Manuel Antonio Flores, in the year 1781.

Appendix No. III.

List of the principal authorities relating to projects of interoceanic communication through the American isthmuses.

Considerations on the Great Isthmus of Central America. Captain R. Fitz Roy, royal navy, in Journal of Royal Geographical Society. Volumes xx, and xxiii. (Library of Congress.)

Report on Interoceanic Ship Canal from San Juan del Norte to Brito, Nicaragua. O. W. Childs and J. D. Fay. 1852. (Observatory library.)

Report to the Directors of the Honduras Interoceanic Railway Company. E. G. Squier, esq. London, 1858. Chemin de fer Interocéanique de Honduras. Rapport de E. G. Squier. Paris, 1855. (Observatory library.)

The Isthmus of Tehuantepec, being the results of a survey for a railroad to connect the Atlantic and Pacific oceans, made by the scientific commission under the direction of Major J. G. Barnard. J. J. Williams, principal assistant engineer. New York, 1852. (Library of Congress; library of State Department.)

Central America. John Bailey. London, 1850. Memoir on the lake of Granada, the river San Juan, and the isthmus between the lake and the Pacific

Digitized by Google

ocean, in Nicaragua. J. Bailey. (A survey under the authority of General Morazan. 1837–'38.) (Library of Congress.)

Survey of the Isthmus of Tehuantepec, 1842–'43, under a scientific Commission appointed by the projector, Don José Garay, 1842. Journal Royal Geographical Society, volume xiv. London, 1844. (Library of Congress.)

Levellings across the Isthmus of Panama, to ascertain the relative height of the Pacific at Panama, and of the Atlantic at the mouth of the river Chagres. John A. Lloyd, in the Philosophical Transactions of the Royal Society for 1830. Supplement to the same in Journal Royal Geographical Society. Volume i. (Observatory library.)

Projet d'un Canal de jonction de l'océan Pacifique et l'océan Atlantique à travers l'Isthme de Panama. Paris, 1845. Napoléon Garella. (Library of Congress.)

Rapport sur le projet de M. Garella, ingénieur en chef des mines. Annales des Ponts et Chaussées Memoires, et Documents. Volume 13. (Library of War Department, Bureau of Engineers.)

L'Isthme de Panama. Examen Historique et géographique des differents directions suivant lesquelles on pourrait le percer, et des moyens à y employer, par M. Chevalier. Paris, 1844. (Library of War Department, Bureau of Engineers.)

L'Isthme de Panama. Memoire de Michel Chevalier in Annales des Ponts et Chaussées. Memoires et Documents, volume 7. (War Department, Bureau of Engineers.)

Report of the Secretary of War, communicating Lieutenent N. Michler's report of his survey for an interoceanic ship canal near the isthmus of Darien. 1861. (Observatory library.)

Nicaragua: The Proposed Interoceanic Canal. E. G. Squier. New York. 1858. (Library of Congress.)

Notes on Central America: The Proposed Honduras Interoceanic Railway. E. G. Squier. New York, 1858.

Memoria sobre la Geografia, Fisica y Politica, de la Nueva Granada. Dedicada à la Sociedad Geografica y Estadistica de Nueva York. Por el General J. C. De Mosquera, presidente de la Nueva Granada, Miembro Honorario de la Sociedad de Agronomia Practica de Paris, &c., &c., &c. New York, 1852.

Incidents of Travel in Central America. J. L. Stephens. 1852. (Observatory library.)

The Junction of the Atlantic and Pacific Oceans by a ship canal without locks, by the valley of the Atrato. (Pamphlet.) F. M. Kelly. New York, 1856.

The union of the oceans by ship canal without locks, *via* the Atrato valley. F. M. Kelly. 1859.

Explorations through the valley of the Atrato to the Pacific in search of a route for a ship canal. F. M. Kelly, New York, in Journal Royal Geographical Society. Volume 26. (Library of Congress.)

Rough notes of an exploration for an interoceanic canal by way of the rivers Atrato and San Juan in New Granada, South America. J. C. Trautwine, civil engineer. Philadelphia, 1854. Also in Journal Franklin Institute. Volumes 1854–'55. (Smithsonian library.)

Noticias Americanas entretenimientos phisico-historicos sobre la America Meridional y la Septentrional Oriental. Antonio de Ulloa. Madrid. 1774. (Library of Congress.)

Conquista de Mexico. F. Lopez de Gomara. Madrid. 1852. (Library of Congress.)

Historica General de las Indias. F. L. Gomara. Madrid, 1852. (Library of Congress.)

Isthmus of Darien ship canal, with history of the Scotch colony of Darien. E. Cullen. London, 1853. (Library of the State Department.)

Digitized by Google

Over Darien by a Ship Canal. A report of the mismanaged expedition of 1854, with suggestions for a survey. E. Cullen, 1856.

William Paterson, the merchant, &c., by S. Bannister; 1858. Edinburg.

Central America, 1701, with a map from a manuscript in British Museum. Wm. Paterson. Edited by S. Bannister. London, 1857. (Library of Congress.)

Journal of the Expedition of Inquiry for the junction of the Atlantic and Pacific oceans. Lionel Gisborne. London, 1853. (Library of Congress.)

Official Report of the Proceedings of the Exploring Party under Commander J. C. Prevost, of her Majesty's steamer Virago, sent to cross the Isthmus of Darien. Journal of the Royal Geographical Society, vol. xxiv. (Library of Congress.)

Observations on the Territory of Burica, in the Province of Chiriqui, Isthmus of Panama. J. H. Smith. Journal of the Royal Geographical Society, vol. xxiv. (Library of Congress.)

The new route through Chiriqui; Harpers' Magazine, January, 1861.

A succinct view and analysis of information on the practicability of joining the Atlantic and Pacific oceans by a ship canal. R. B. Pitman. London, 1825. (Library of Congress.)

Considerations sur les interets politiques et commerciaux qui se rattachent à l'Isthme de Panama. A. Denain. Paris, 1845. (Library of Congress.)

Writings of William Paterson, with a biographical introduction, 2 vols. 8vo., 1858.

History of the Buccaniers of America, 2 vols., London, 1741. (Library of Congress.)

Memoirs of Great Britain and Ireland. Sir John Dalrymple, vol. ii. (Library of Congress.)

The Isthmus of Tehuantepec; Herr M. G. Hermesdorff. Journal of the Royal Geographical Society, vol. xxxii. (Library of Congress.)

Einige Technische Nachrichten von den Entwürfen zur verbindung des Mittelmeeres mit dem Rothen meere bei Suez und des Atlantischen meeres mit dem Stillen meere bei Panama durch canale und Eisenbahnen. Berlin, 1846. (Admiralty library.)

The practicability and importance of a ship canal to connect the Atlantic and Pacific oceans, with a history of the enterprise from its first inception to the completion of the survey. Pamphlet. New York, 1855. (Kennish's survey.) (Admiralty library.)

Memoria Historica sobre el canal de Nicaragua. Guatemala, 1855. (Admiralty library.)

Account of the Isthmus of Tehuantepec, with proposals for establishing a communication between the Atlantic and Pacific oceans. Pamphlet. London. 1846. (Admiralty library.)

Political Essay upon New Spain; Alex. von Humboldt. Essai Politique sur le Royaume de Nouvelle Espagne; Alex. von Humboldt. (Library of Congress.)

Observations on the Isthmus of Panama; Wheelwright, 1843. Library of Congress.)

Voyage around the Globe; W. Dampier. London, 1729. (Library of Congress.)

Encyclopædia Britannica, vols. ii, v, vii, viii, xii, xvi, xvii. (Observatory library.)

Bulletin of the American Geographical and Statistical Society for 1854, for interoceanic communication across the Isthmus of Panama or Darien, by George B. Watts. (Observatory library.)

Bulletin of the American Geographical and Statistical Society for 1859, for "the Isthmus of Tehuantepec," by J. McL. Murphy. (Observatory library.)

Digitized by Google

Mittheilungen aus Justus Perthes, Geographischer Anstalt; Dr. A. Peterman. Vols. for 1861–'62–'63. (Observatory library.)

Voyage and Description of the Isthmus of Darien; Lionel Wafer. London. 1699. (Library of Congress.)

Central America: Colonel Don Juan Galindo, corresponding member Royal Geographical Society; Journal of Society, vol. vi. (Library of Congress.)

Message of the President of the United States in relation to Central America. 1850. (Observatory library.)

Speech of Hon. Edward Everett. 1853. (Observatory library.)

Speech of Hon. E. Ward, of New York. February 15, 1859. (Observatory library.)

Œuvres de Napoléon III, vol. 2.

Pamphlet on Nicaragua, with initials L. N. B.; published in London, 1847, and reprinted in Revue Britannique for 1859, and M. Belly's "Percements de l'Isthme." London, 1859.

Official despatch No. 278 from the American minister at Berlin, Mr. Wheaton, to the Secretary of State, December 17, 1845. [29th Cong., 2d sess., Exec., "confidential."] (Library of the Department of State.)

The Leader. (England.) July 31, 1858.

Panama, Nicaragua, and Tehuantepec; the Question of Communication between the Atlantic and Pacific; W. B. Liot. London, 1849. (Library of Congress.)

Seven Years' Travel in Central America, New Mexico, &c.; Julius Froebel. London, 1859. (Library of Congress.)

The Gate of the Pacific; Commander Bedford Pim, R. N. 1863. (Library of Congress.)

Proceedings of the Royal Geographical Society for 1861–'62 for the Discussion of Pim's Route. (Observatory library.)

Edinburgh Review for January 1809, and vol. xvi. (Library of the State Department.)

London Times, November 28 and December 11, 1850, and for February, 1853. (Library of the State Department.)

Colburn's New Monthly Magazine, July to December, 1850.

Report of British Association for 1850. (Observatory library.)

Canal Interocéanique par l'Isthme de Darien, Nouvelle Granada; (Amérique du Sud;) Canalization par Colonization. Paris, 1860. A. Airiau. (Astor library.)

Du Projet de Communication Interocéanique par l'Isthme de Darien; V. A. Malte-Brun. Bulletin de la Société de Géographie de Paris, 1857. (Library of Congress.)

Exploration dans l'Isthme de Darien; par M. Bourdiol, ingénieur civil; 1864. (Bulletin de la Société de Géographie de Paris, 1864. (Library of Congress.)

Report on the Progress of Geographical Science for the year 1864; V. A. Malte-Brun. (Bulletin de la Société de Géographie de Paris, 1864.) Library of Congress.)

Annales des Voyages for 1857 for description of eighteen different routes across the Isthmus; by V. A. Malte-Brun. Ditto, for chart of New Granada. Vol. 16, for 1811. (Astor library.)

The Darien Papers; A Selection of Original Letters and Official Documents relating to the establishment of a colony at Darien, by the company of Scotland trading to Africa and the Indies. Edinburgh, 1849. (Library of Congress.)

Canalization des Isthmes de Suez et de Panama; par les frères de la Compagnie Maritime de Saint Pie, ordre Religieux, Militaire, et Industriel. Paris, 1848. (Astor library.)

Report to the Hon. Secretary of the Navy; by Lieutenant J. G. Strain, October 25, 1854.

Digitized by Google

A Paper on the History and Prospects of Interoceanic Communications by the American Isthmus; J. G. Strain. New York, 1856. (Astor library.)

Panama in 1855; An Account of the Panama Railroad, of the Cities of Panama and Aspinwall, with sketches of Life on the Isthmus. New York, 1855. (Astor library.)

Memoir of the Mexican Revolution. W. Robinson; 1820. (Library of Congress.)

Canal Interoceanico, 1866; Bogotá. Imprenta de Gaitau. (Observatory library.)

Annales des Ponts et Chaussées; Planches; 1841 to 1845, and 1846 to 1850. (Library of War Department, Bureau of Engineers.)

Summary of Report on survey of the Isthmus of Darien, by Lionel Gisborne, F. R. G. S., in Journal Royal Geographical Society, vol. 27. (Library of Congress.)

Report on European Tunnels, by Charles S. Storrow, A. M., C. E., A. A. S. (Report of the Commissioners upon the Troy and Greenfield Railroad and Hoosac Tunnel, February 28, 1863; Massachusetts senate, No. 93.)

Seeman's Voyage of her Majesty's Ship Herald, 2 vols., 1853. (Observatory library.)

Journal Society of Arts; London, January 23, 1857. (Observatory library.)

Harpers' Weekly; March 20, 1858. (Observatory library.)

The Bayanos River, Isthmus of Panama, by Laurence Oliphant, Secretary Royal Geographical Society, in proceedings of Royal Geographical Society; April 24, 1865. (Observatory library.)

Nicaragua, Past, Present, and Future, by P. A. Stout; Philadelphia, 1859. (Library of Congress.)

Explorations and Adventures in Honduras; W. O. Wells, 1857. (Library of Congress.)

Jefferson's Works. (Library of Congress.)

Treaty between the United States and New Granada; 1848.

Clayton-Bulwer Treaty; 1850.

Report of Colonel G. W. Hughes; Survey of Panama Railroad; 1849.

Report of a Survey for a Railroad through the Province of Chiriqui; Commodore Frederick Engle, U. S. N.; Assistants, Lieutenant Wm. N. Jeffers, U. S. N., hydrographic engineer; Lieutenant J. St. Clair Morton, U. S. Eng., topographical engineer; Dr. Evans, Geologist. (New York Herald, December 8, 1860.)

Notes of an Excursion to the Isthmus of Tehuantepec. R. Dale. London, 1851. (Library of Congress.)

Travels in the Free States of Central America. Carl Scherzer. London, 1857. (Library of Congress.)

La Prossima Comunicazione di tutt 'i Popoli Della Terra, (avec carte.) Memoria Statistico Geografica, del Cav. Ferd. de Luca.

Notice sur le Golfe Dulce dans l'État de Costa Rica, (Amérique Centrale,) et sur un Nouveau Passage entre les deux Océans, avec une carte, par M. Gabriel Lafond de Lurcy, Consul Général, Chargé d'Affaires de Costa Rica en France. Paris, 1856.

The Isthmus of Panama. By Charles Tolwell Bidwell, F. R. G. S., British.

Canal Interocéanique du Darien Amérique. Notice historique et géographique sur l'état de la question du canal du Darien, par M. V. A. Malte-Brun. Paris, 1866.

Annales de la Societé de Géographie for 1865 and 1866.

La question du percement de l'Isthme de Panama, devant un congrès internationale, par H. Bionne. Paris, 1866.

Illustrated History of the Panama Railroad, F. N. Otis, M. D. New York, 1862.

Digitized by Google

Notes sur le fleuve du Darien et sur la configuration du Sol au point de vue du tracé d'un canal interoceanique entre le Rio Grande du Darien et l'Atrato, par M. Jules Flachat, 1 broch., en 8 vo. de 48 pages et 2 planches. Paris 1866.

Report by Hon. C. Fenton Mercer, chairman Committee on Roads and Canals, on the memorial of Aaron Clark, mayor of New York, H. Le Roy, W. Radcliff, and other merchants of New York, and Mathew Carey, of Philadelphia, praying aid of the United States in procuring the construction of a canal across the isthmus between North and South America. Executive Documents, twenty-fifth Congress, third session, House of Representatives.

Interoceanic Railroad through the Republic of Costa Rica, by F. Kurtze, C. E., Director general of public works, New York, Gray & Green, 1866.

Eine Reise in das Innere der Landenge von San Blas, und der Cordillere von Chepo in der Provinz Panama. Von Dr. Moriz Wagner, Mittheilungen aus Justus Perthes' Geographischer Anstalt, 1862.

See, also, the authorities cited by Admiral Fitz Roy, in Journal Royal Geographical Society, vol. xx, which are not given in the preceding list, viz: Admiralty Hydrographic Office; Alcedo; Burney; Cochrane; Coutin; Edwards; Falmarc; Galindo; Guzman; Hamilton; Hughes; Jeffreys; Juan; Lawrence; McQueen; Mollien; O'Leary; Purdy; Scarlett; Watts; Wood.

Digitized by Google

PARSONS LIBRARY
University of
MICHIGAN

Digitized by Google

Digitized by Google

PARSONS LIBRARY
University of
MICHIGAN

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

17

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

12

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

UNIVERSITY OF MICHIGAN
3 9015 06719 8997

Digitized by Google